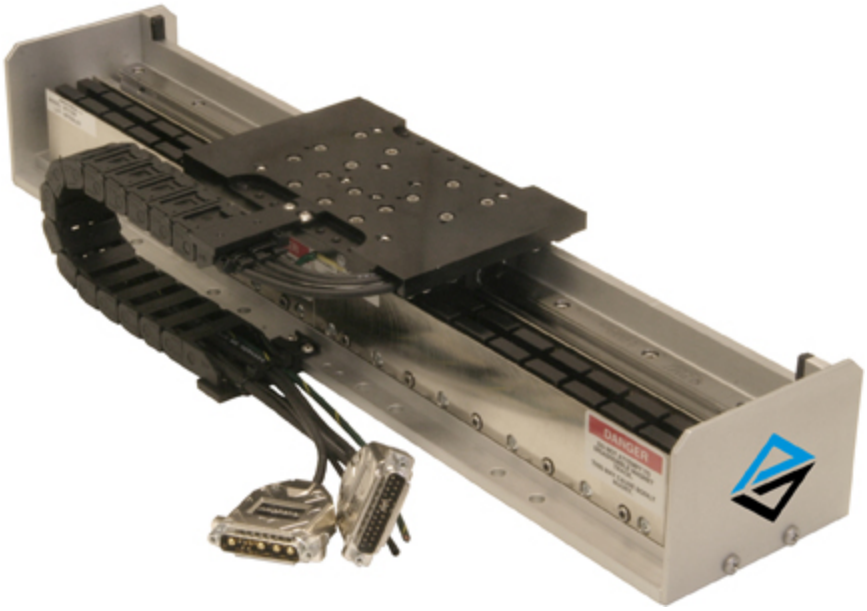
ACT Series Linear Motor
Actuator User's Manual

P/N: EDS171 (Revision 1.01.00)



Dedicated to the Science of Motion

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NOTE: This manual and any additional instructions included with the ACT should be read in their entirety before operating the ACT .

NOTE: Product names mentioned herein are used for identification purposes only and may be trademarks of their respective companies.

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Chapter 1: Overview

This manual describes Aerotech's ACT series of linear motor actuators. Figure 1-1 shows a typical ACT linear motor actuator.

The ACT is a high performance, cost-effective, linear-servomotor-driven actuator that is faster and more accurate than a ball screw or belt-drive actuator. The ACT is ideal for applications including assembly, pick and place machines, electronic assembly and qualification, packaging, vision inspection, dispensing, life sciences, image scanning and processing, and inkjet printing.

The ACT series supports travel distances ranging from 100 mm to 1500 mm.

This chapter introduces standard and optional features of the ACT linear motor actuators and gives general safety precautions.

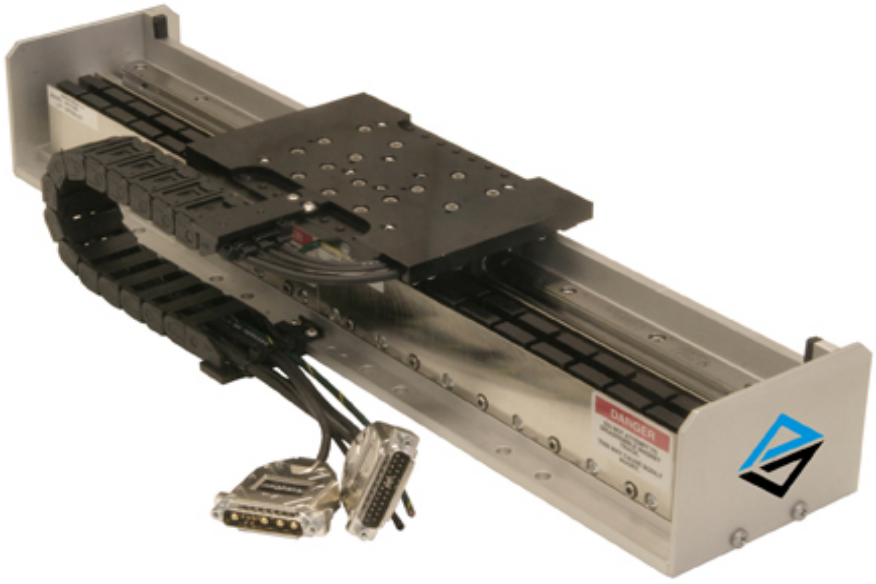


Figure 1-1: Typical ACT Series Linear Motor Actuator

NOTE: Aerotech continually improves its product offerings; listed options may be superseded at any time. Refer to the most recent edition of the Aerotech Motion Control Product Guide for the most current product information at www.aerotech.com.

1.1. Standard Features

The ACT series incorporates a linear motion guide (LMG), a high power cog-free linear motor, and a high accuracy non-contact linear optical encoder as standard features to provide a high performance, cost-effective linear actuator that is virtually maintenance-free. Because the ACT actuators consist of non-contact linear motors and encoders, there is no backlash, windup or wear that is normally associated with contacting-type systems such as ball screws or belt drives.

Limit switches and mechanical stops, which protect the carriage from over-travel, are also standard features of every ACT linear motor actuator.

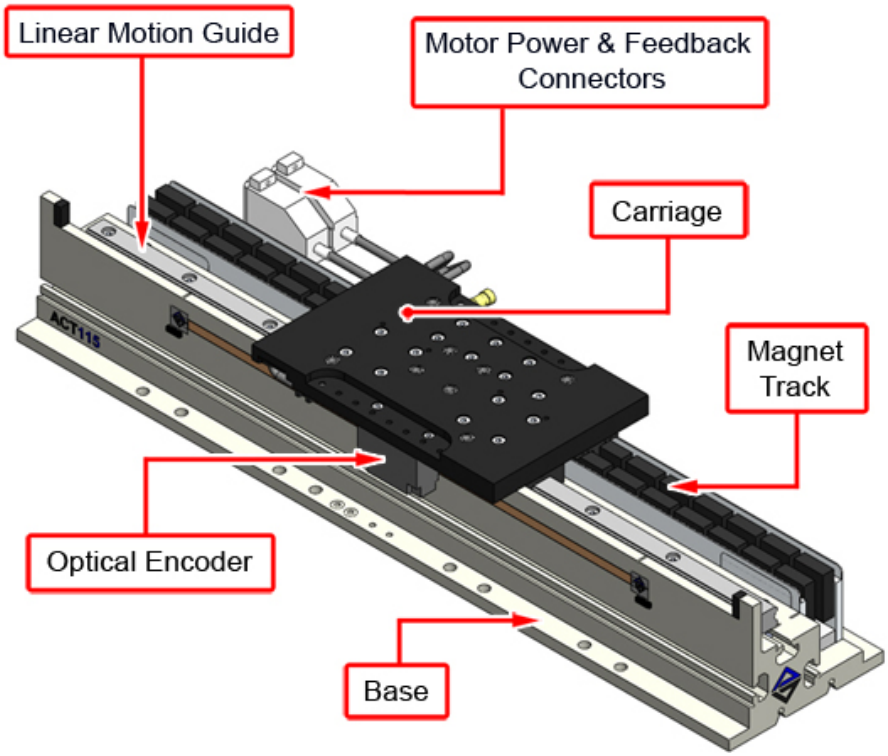


Figure 1-2: ACT Series Linear Motor Actuator

1.1.1. Optional Features

Available assembly options allow the ACT series linear motor actuators to be configured for a variety of applications.

The non-contact linear optical encoder is available with either a line-driver output or an amplified sine-wave output for maximum application flexibility. Various resolutions and clock rates are available upon request for encoders with line-driver outputs.

For applications requiring the easy adjustment of useable travel, the ACT series linear motor actuators can be equipped with optional moveable limits.

A bulkhead termination bracket option is available for OEM or applications requiring user-defined cable management. In cases where a complete solution is needed, an optional cable management chain can be provided.

Optional air cooling of the linear motor is offered for high duty cycle and heavy payload applications.

For critical applications, an option is available to verify the accuracy and repeatability performance of the ACT linear motor actuator by performing metrology testing at the factory. In addition, a linear error correction option is offered for those applications requiring the highest level of accuracy.

Aesthetic end plates are also available for all models of the ACT series linear motor actuators.

Refer to Figure 1-3 for examples of some of the optional features available on the ACT linear motor actuators.

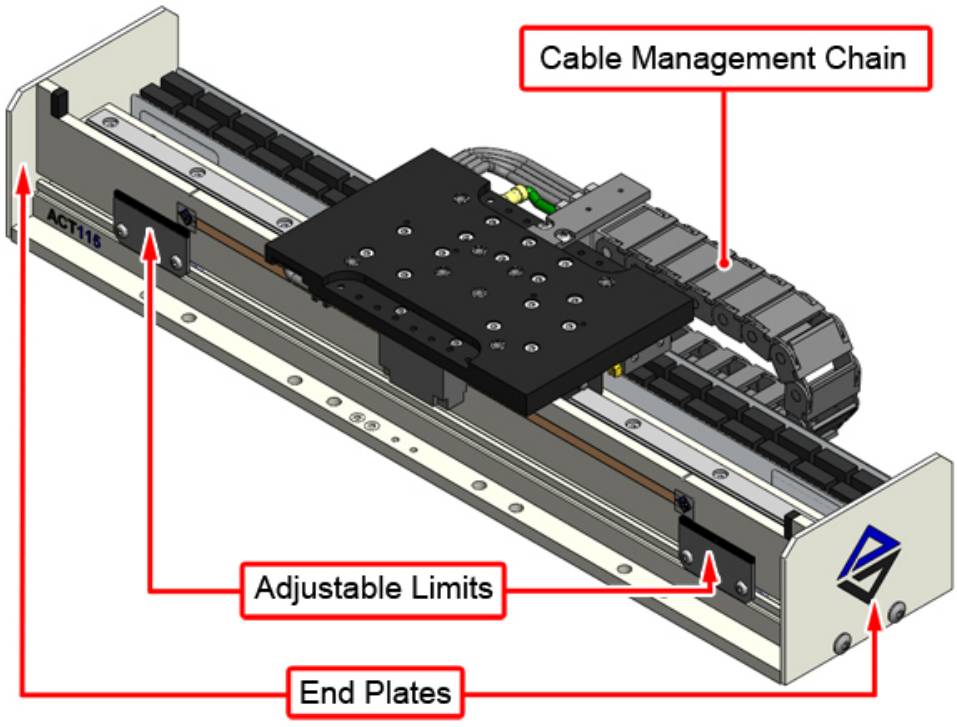


Figure 1-3: Examples of Optional Features

1.1.2. Model Numbers

The following table provides an ordering example for a typical ACT linear motor actuator and a list of available options. Aerotech continually improves its product offerings, and listed options can be superseded at any time. For the most current product information, see the most recent edition of the Aerotech Motion Control Product Guide at www.aerotech.com.

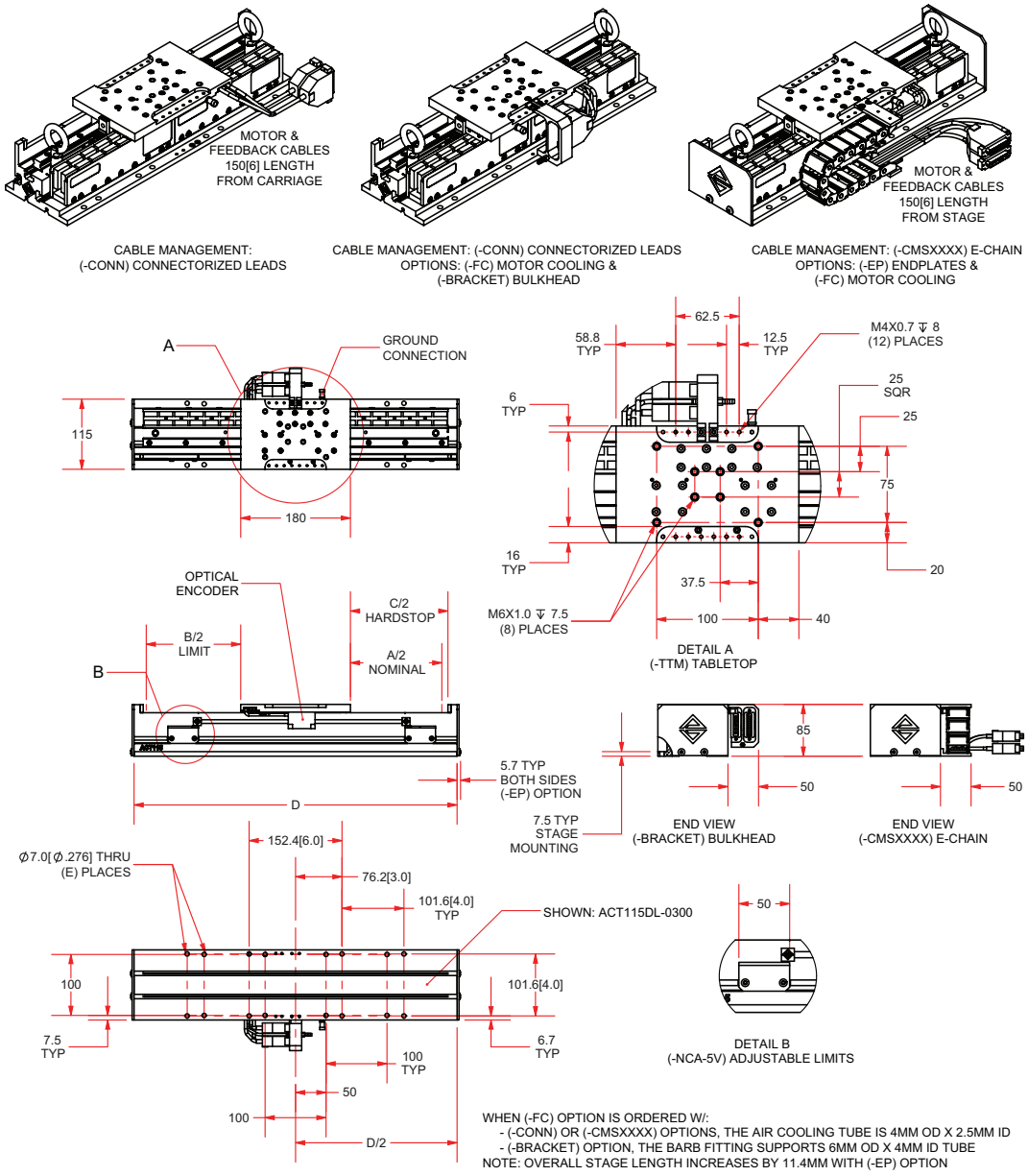
Table 1-1: Model Numbers and Ordering Options

ACTxxxDL Series Linear Motor Actuator	
ACT115DL	Linear actuator with BLMC-142-A motor
ACT140DL	Linear actuator with BLM-142-A motor
ACT165DL	Linear actuator with BLMH-142-A motor
Travel	
-0100	100 mm travel linear motor actuator
-0200	200 mm travel linear motor actuator
-0300	300 mm travel linear motor actuator
-0400	400 mm travel linear motor actuator
-0500	500 mm travel linear motor actuator
-0600	600 mm travel linear motor actuator
-0800	800 mm travel linear motor actuator
-1000	1000 mm travel linear motor actuator
-1200	1200 mm travel linear motor actuator
-1500	1500 mm travel linear motor actuator
Tabletop	
-TTM	Metric dimension mounting pattern and holes (standard)
Standard Linear Feedback	
-AS	Linear optical encoder; 20 µm/Vpp output
-0.1	Linear optical encoder; 0.1 µm line driver output
-0.5	Linear optical encoder; 0.5 µm line driver output
Limits	
-NC-5V	5 V normally-closed end of travel limit switches with fixed locations (standard)
-NCA-5V	5 V normally-closed end of travel limit switches with adjustable location
Cable Management	
-CONN-NH	150 mm (6 inch) connectorized leads from carriage; no cable management system; no linear motor Halls
-CONN-H	150 mm (6 inch) connectorized leads from carriage; no cable management system; linear motor Halls
-CMSXXXX-H	Cable management system for 100 mm to 1500 mm single-axis applications; linear motor Halls

Table 1-1: Ordering Options (continued)

Options	
-FC	Includes air cooling of linear motor forcer (20 psi compressed air supply required)
-EP	End plates mounted on linear actuator base
-BRACKET	Bulkhead bracket mounting kit for installing motor and feedback connectors onto carriage (for use with -CONN-NH and -CONN-H options). Installation of kit by end user is required.
Metrology	
-NO PLOTS	No testing of stage; no performance plots provided
-PLOTS	Accuracy and repeatability testing of uncalibrated stage; performance plots provided
Accessories (to be ordered as separate line item)	
-HALAR	High-accuracy system; linear error correction for accuracy and repeatability

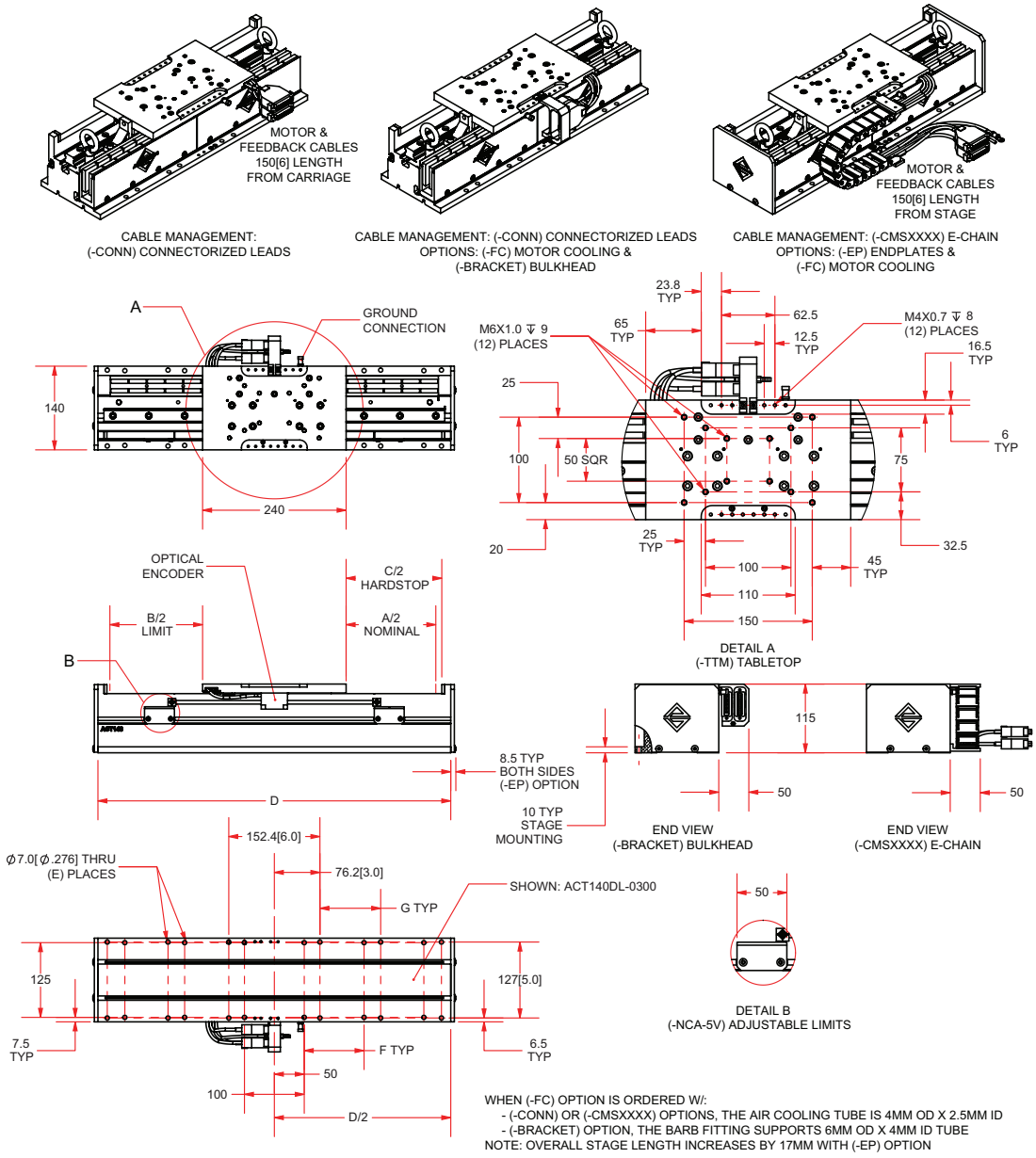
1.2. Dimensions



MODEL #	A = NOMINAL	B = LIMIT	C = HARDSTOP	D = STAGE LENGTH	E = MOUNTING
ACT115DL-0100	100	110	120	330	8
ACT115DL-0200	200	210	220	430	16
ACT115DL-0300	300	310	320	530	16
ACT115DL-0400	400	410	420	630	24
ACT115DL-0500	500	510	520	730	24
ACT115DL-0600	600	610	620	830	32
ACT115DL-0800	800	810	820	1030	40
ACT115DL-1000	1000	1010	1020	1230	48
ACT115DL-1200	1200	1210	1220	1430	56
ACT115DL-1500	1500	1510	1520	1730	64

DIMENSIONS: MILLIMETERS[INCHES]

Figure 1-4: ACT115DL Series Linear Motor Actuator Dimensions



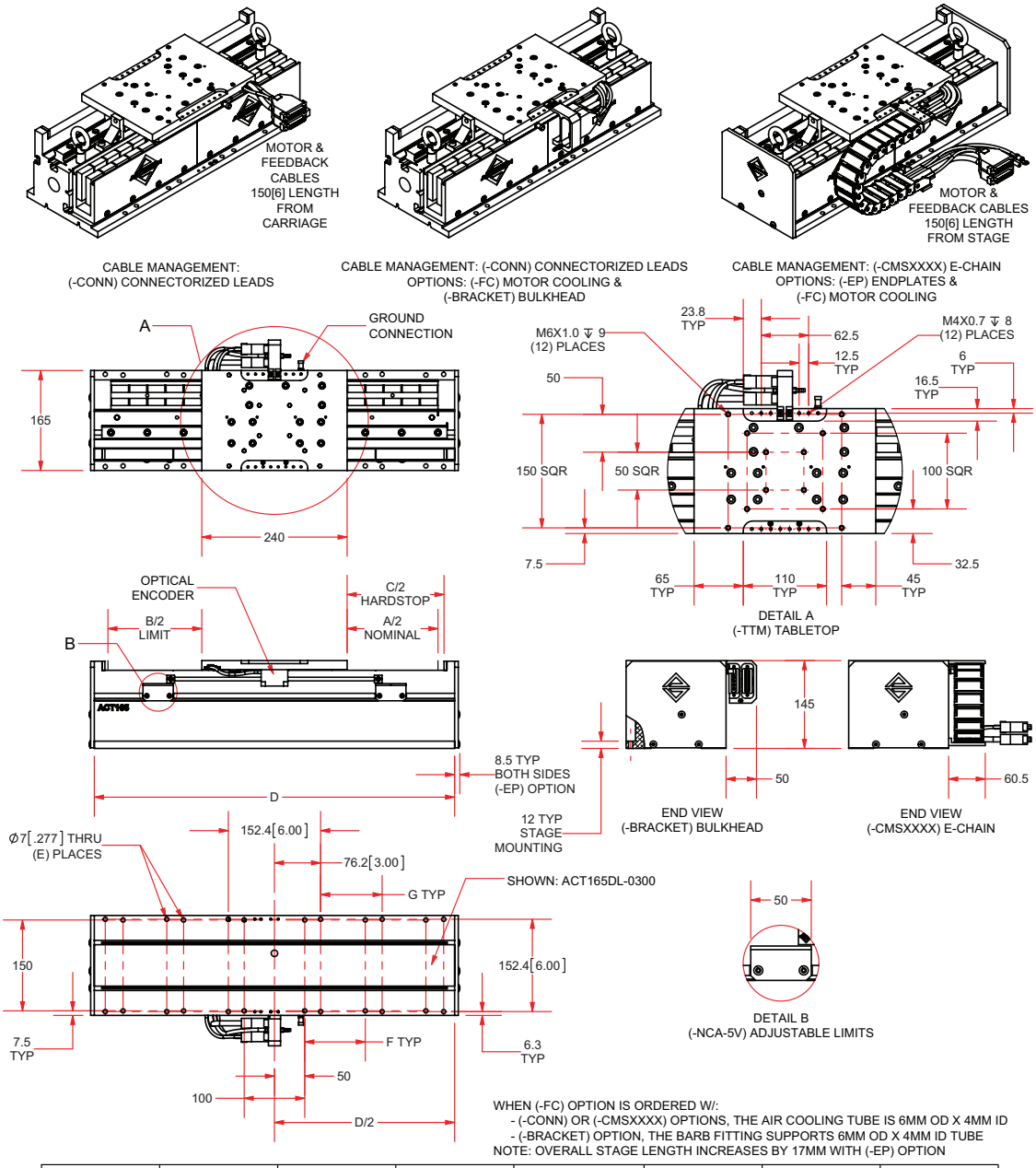
WHEN (-FC) OPTION IS ORDERED W/:
- (-CONN) OR (-CMSXXXX) OPTIONS, THE AIR COOLING TUBE IS 4MM OD X 2.5MM ID
- (-BRACKET) OPTION, THE BARB FITTING SUPPORTS 6MM OD X 4MM ID TUBE

NOTE: OVERALL STAGE LENGTH INCREASES BY 17MM WITH (-EP) OPTION

MODEL #	A = NOMINAL	B = LIMIT	C = HARDSTOP	D = STAGE LENGTH	E = MOUNTING	F = SPACING	G = SPACING
ACT140DL-0100	100	105	120	390	16	75	76.2[3.0]
ACT140DL-0200	200	205	220	490	16	100	101.6[4.0]
ACT140DL-0300	300	305	320	590	24	100	101.6[4.0]
ACT140DL-0400	400	405	420	690	24	100	101.6[4.0]
ACT140DL-0500	500	505	520	790	32	100	101.6[4.0]
ACT140DL-0600	600	605	620	890	32	100	101.6[4.0]
ACT140DL-0800	800	805	820	1090	40	100	101.6[4.0]
ACT140DL-1000	1000	1005	1020	1290	48	100	101.6[4.0]
ACT140DL-1200	1200	1205	1220	1490	56	100	101.6[4.0]
ACT140DL-1500	1500	1505	1520	1790	64	100	101.6[4.0]

DIMENSIONS: MILLIMETERS [INCHES]

Figure 1-5: ACT140DL Series Linear Motor Actuator Dimensions



WHEN (-FC) OPTION IS ORDERED W/:
- (-CONN) OR (-CMSXXXX) OPTIONS, THE AIR COOLING TUBE IS 6MM OD X 4MM ID
- (-BRACKET) OPTION, THE BARB FITTING SUPPORTS 6MM OD X 4MM ID TUBE

NOTE: OVERALL STAGE LENGTH INCREASES BY 17MM WITH (-EP) OPTION

MODEL #	A = NOMINAL	B = LIMIT	C = HARDSTOP	D = STAGE LENGTH	E = MOUNTING	F = SPACING	G = SPACING
ACT165DL-0100	100	105	120	395	16	75	76.2[3.00]
ACT165DL-0200	200	205	220	495	16	100	101.6[4.00]
ACT165DL-0300	300	305	320	595	24	100	101.6[4.00]
ACT165DL-0400	400	405	420	695	24	100	101.6[4.00]
ACT165DL-0500	500	505	520	795	32	100	101.6[4.00]
ACT165DL-0600	600	605	620	895	32	100	101.6[4.00]
ACT165DL-0800	800	805	820	1095	40	100	101.6[4.00]
ACT165DL-1000	1000	1005	1020	1295	48	100	101.6[4.00]
ACT165DL-1200	1200	1205	1220	1495	56	100	101.6[4.00]
ACT165DL-1500	1500	1505	1520	1795	64	100	101.6[4.00]

DIMENSIONS: MILLIMETERS [INCHES]

Figure 1-6: ACT165DL Series Linear Motor Actuator Dimensions

1.3. Safety Procedures and Warnings

The following statements apply wherever the Warning or Danger symbol appears within this manual. Failure to observe these precautions could result in serious injury to those individuals performing the procedures and/or damage to the equipment. Operators should be trained before operating this equipment.

DANGER: To minimize the possibility of electrical shock and bodily injury or death, disconnect all electrical power prior to making any electrical connections.

DANGER: To minimize the possibility of electrical shock and bodily injury or death when any electrical circuit is in use, ensure that no person comes in contact with the circuitry when the ACT is connected to a power source.

DANGER: To minimize the possibility of bodily injury or death, disconnect all electrical power prior to making any mechanical adjustments.

DANGER: Moving parts of the ACT can cause crushing or shearing injuries. All personnel must remain clear of any moving parts.

WARNING: Improper use of the linear motor actuator can cause damage, shock, injury, or death. Read and understand this manual before operating the linear motor actuator.

WARNING: Cables can pose a tripping hazard. Securely mount and position all ACT cables to avoid potential hazards.

WARNING: Do not expose the ACT to environments or conditions outside the specified range of operating environments. Operation in conditions other than those specified can cause damage to the equipment.

WARNING: The ACT must be mounted securely. Improper mounting can result in injury and damage to the equipment.

WARNING: Use care when moving the ACT. Manually lifting or transporting the ACT can result in injury.

WARNING: Only trained personnel should operate, inspect, and maintain the ACT.

WARNING: This ACT is intended for light industrial manufacturing or laboratory use. Use of the ACT for unintended applications can result in injury and damage to the equipment.

WARNING: Before using this ACT, perform an operator risk assessment to determine the needed safety requirements.

1.4. EC Declaration of Incorporation

Manufacturer: Aerotech, Inc.
101 Zeta Drive
Pittsburgh, PA 15238
USA

herewith declares that the product:

Aerotech, Inc. ACT Linear Motor Actuator

is intended to be incorporated into machinery to constitute machinery covered by the Directive 2006/42/EC as amended;

does therefore not in every respect comply with the provisions of this directive;

and that the following harmonized European standards have been applied:

EN ISO 12100-1,-2:2003+A1:2009
Safety of machinery - Basic concepts, general principles for design
ISO 14121-1:2007
Safety of machinery - Risk assessment - Par 1: Principles
EN 60204-1:2005
Safety of machinery - Electrical equipment of machines - Part 1: General requirements

and further more declares that

it is not allowed to put the equipment into service until the machinery into which it is to be incorporated or of which it is to be a component has been found and declared to be in conformity with the provisions of the Directive 2006/42/EC and with national implementing legislation, i.e. as a whole, including the equipment referred to in this Declaration.

Authorized Representative: Manfred Besold
Address: AEROTECH GmbH
Süd-West-Park 90
D-90449 Nürnberg

Name: Alex Weibel /
Position: Engineer Verifying Compliance
Location: Pittsburgh, PA
Date: December 30, 2011

Chapter 2: Installation

This chapter describes the installation procedure the ACT series linear motor actuators, including handling the linear motor actuator correctly, securing the linear motor actuator to the mounting surface, attaching the payload, and making the electrical connections.

WARNING: Installation must follow the instructions in this chapter. Failure to follow these instructions could result in injury and damage to the equipment.

2.1. Unpacking and Handling the Linear Motor Actuator

Carefully remove the linear motor actuator from the protective shipping container. Most ACT series linear motor actuators come equipped with lifting features attached to the base, as shown in Figure 2-1. Use these lifting features in conjunction with lifting straps to handle the linear motor actuator. If lifted by hand, the linear motor actuator should be lifted from the bottom of the base. Do not attempt to lift or move the linear motor actuator by the carriage, cable brackets or end plates. For multi-axis assemblies, always lift the system by the lower axis. Lifting by the upper axis can disturb precision alignments on the system.

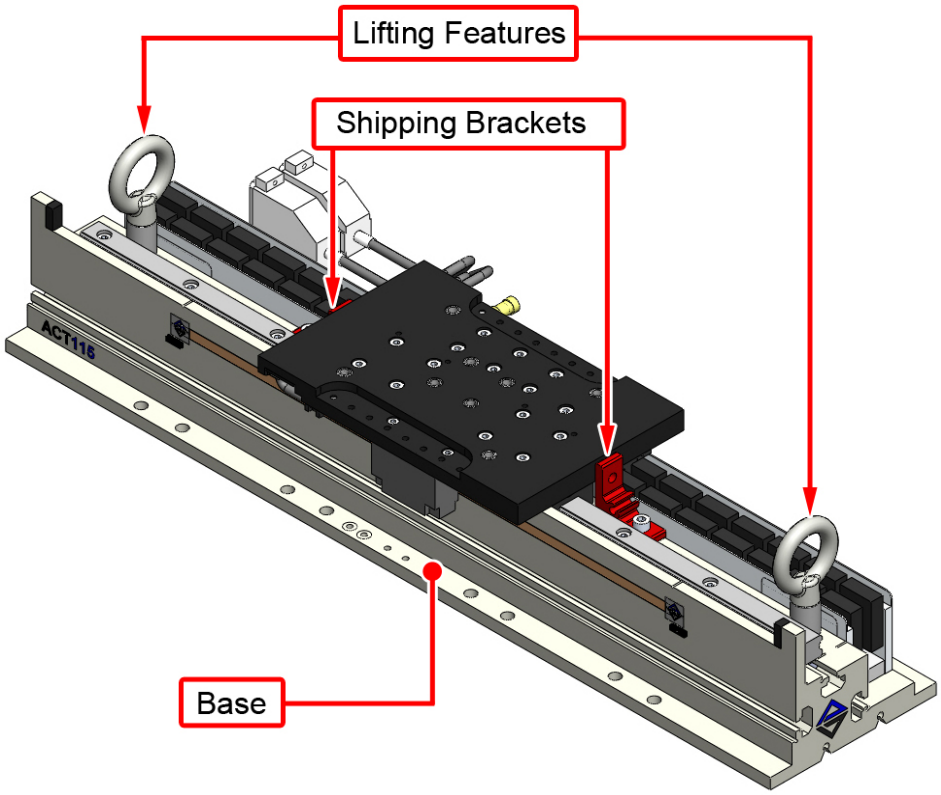


Figure 2-1: Lifting Features

Each ACT has a label listing the system part number and serial number. These numbers contain information necessary for maintaining or updating system hardware and software. Locate this label and record the information for later reference. If any damage has occurred during shipping, report it immediately.

WARNING: Improper handling could adversely affect the ACT's performance. Use care when moving the stage.

WARNING: Use care when moving the ACT. Manually lifting or transporting the ACT can result in injury.

WARNING: Lift the ACT only by the base.

2.2. Preparing the Mounting Surface

The mounting surface should be flat and have adequate stiffness in order to achieve the maximum performance from the ACT. When an ACT series linear motor actuator is mounted to a non-flat surface, the linear motor actuator can be distorted as the mounting screws are tightened. This distortion will decrease the overall accuracy of the linear motor actuator. Adjustments to the mounting surface must be done before the linear motor actuator is secured. The effects of flatness on mounting are illustrated in Figure 2-2.

NOTE: To maintain accuracy, the mounting surface should be flat within 15 µm per 150 mm.

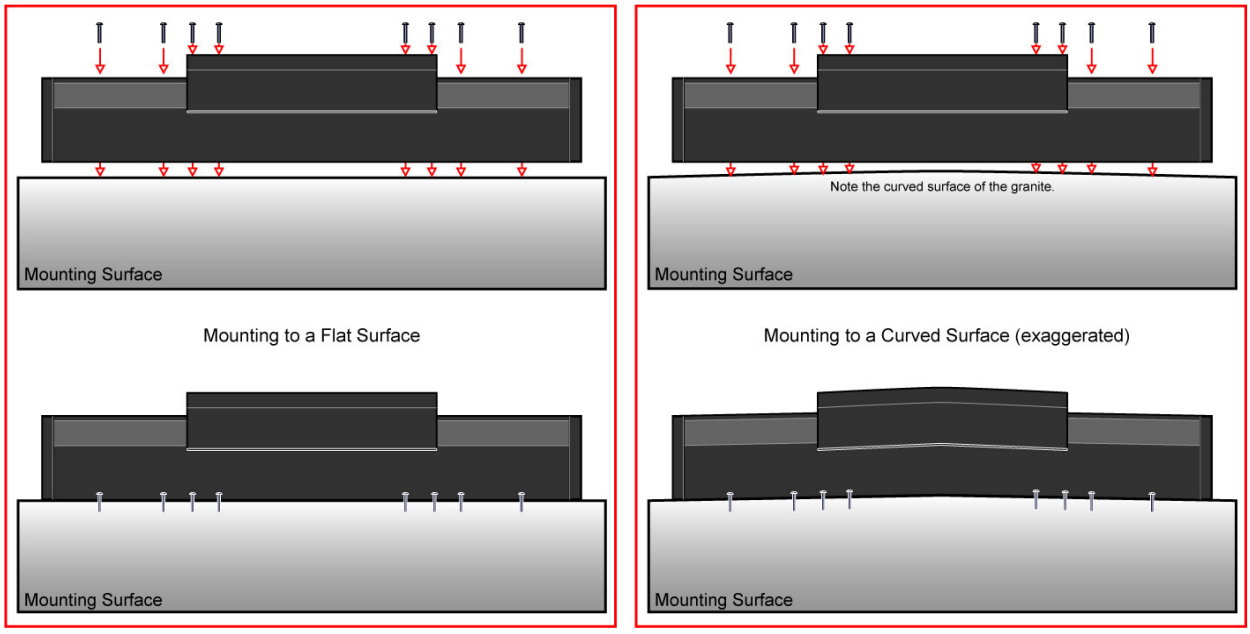


Figure 2-2: Results of Flat Versus Non-Flat Mounting

NOTE: The ACT base is precision machined and verified for flatness prior to product assembly at the factory. If machining is required to achieve the desired flatness, it should be performed on the mounting surface rather than the ACT base. Shimming should be avoided if possible. If shimming is required, it should be minimized to improve the rigidity of the system.

2.3. Securing the Stage to the Mounting Surface

DANGER: Strong rare-earth magnets are present in the linear motor magnet track. Loose metal objects (tools, watches, keys, etc.) may cause personal injury and/or damage to the equipment.

WARNING: The ACT must be mounted securely. Improper mounting can result in injury and damage to the equipment.

Procedure for ACT linear motor actuator mounting:

1. Prepare the mounting surface and bottom of the linear motor actuator base by stoning with precision flat stones to remove any burrs or high spots.
2. Clean the mounting surface and bottom of the linear motor actuator with the appropriate cleaners (isopropyl alcohol for the bottom of the linear motor actuator).
3. Place the linear motor actuator on the mounting surface.
4. Remove the lifting features and shipping brackets (refer to Figure 2-1). The lifting features consist of the eyebolts that are directly threaded into the linear motor actuator base through standoff spaces. They can be removed by tightening a wrench on the head of the eyebolt.

WARNING: Do not attempt to move the ACT's carriage (or table top) until the lifting brackets and shipping brackets have been removed. Moving the carriage with the lifting brackets and shipping brackets installed can cause permanent damage to the ACT.

NOTE: After removing the lifting features or shipping brackets, retain them for future use. In the event that the product requires service at the factory, the lifting features or shipping brackets should be reattached to ensure that the ACT ships safely.

5. If necessary, manually move the carriage to access the 7 mm (0.28 in) diameter mounting holes along the edges of the base. The ACT linear motor actuators are designed to use socket head cap screws (SHCS) to secure the base to the mounting surface. Use either M6 or 1/4" SHCS with flat washers to provide at least 1.5x diameter thread engagement. Tighten the mounting screws to 8 N-m (6 ft-lb) torque.

WARNING: Do not attempt to manually move the linear motor actuator if it is connected to a power source.

2.4. Attaching the Payload to the Linear Actuator

To prevent damage to payloads, test the operation of the linear motor actuator before the payload is attached to the carriage. Proceed with the electrical installation and test the motion control system in accordance with the system documentation. Document all results for future reference. For information on electrical connections, refer to Section 2.6. and the documentation delivered with the stage.

The payload should be flat, rigid, and comparable to the linear motor actuator in quality.

NOTE: For valid system performance, the mounting interface should be flat within 5 µm per 50 mm.

2.5. Bulkhead Connector Bracket Installation

These instructions apply only to those linear motor actuators that have been supplied with a -BRACKET bulkhead bracket mounting kit. The -BRACKET bulkhead mounting kid provides the user with the necessary hardware for mounting the motor and feedback connectors directly onto the carriage of any linear motor actuator constructed with either the -CONN-H or -CONN-NH cable management options.

Note that installation and use of the -BRACKET bulkhead mounting kit along does not constitute a correct electrical cable strain relief as described in Section 2.7. The user must still implement a correct electrical cable strain relief, or premature failure of the linear motor actuator and damage to the equipment can result.

Procedure for -BRACKET bulkhead mounting kit installation:

1. Disassemble the jacksockets from the linear motor actuator's motor power and feedback connectors (refer to Figure 2-3). These jacksockets can be discarded after removal.
2. Attach the bulkhead connector bracket to the carriage using the M4 x 8 mm long button head socket cap screws (BHCS) provided (refer to Figure 2-4).
3. Attach the linear motor actuator's motor power and feedback connectors to the bulkhead connector bracket using the jacksockets provided (refer to Figure 2-5).
4. If the linear motor actuator is equipped with the -FC linear motor forcer cooling option, install the barbed air fittings provided in the kit onto the bulkhead connector bracket. Use the small barbed air fitting with the ACT115DL and ACT140DL models. Use the large barbed air fitting with the ACT165DL models. Attach the air hose from the linear motor actuator's carriage onto the appropriate barbed fitting (refer to Figure 2-6).

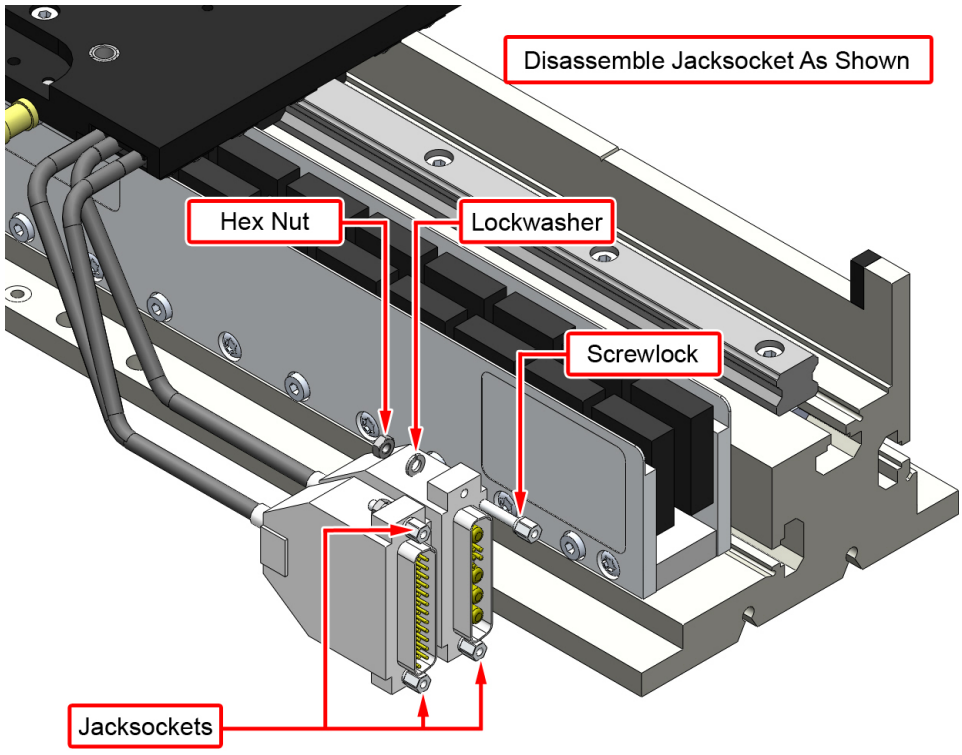


Figure 2-3: Bulkhead Bracket Installation — Jacksocket Disassembly

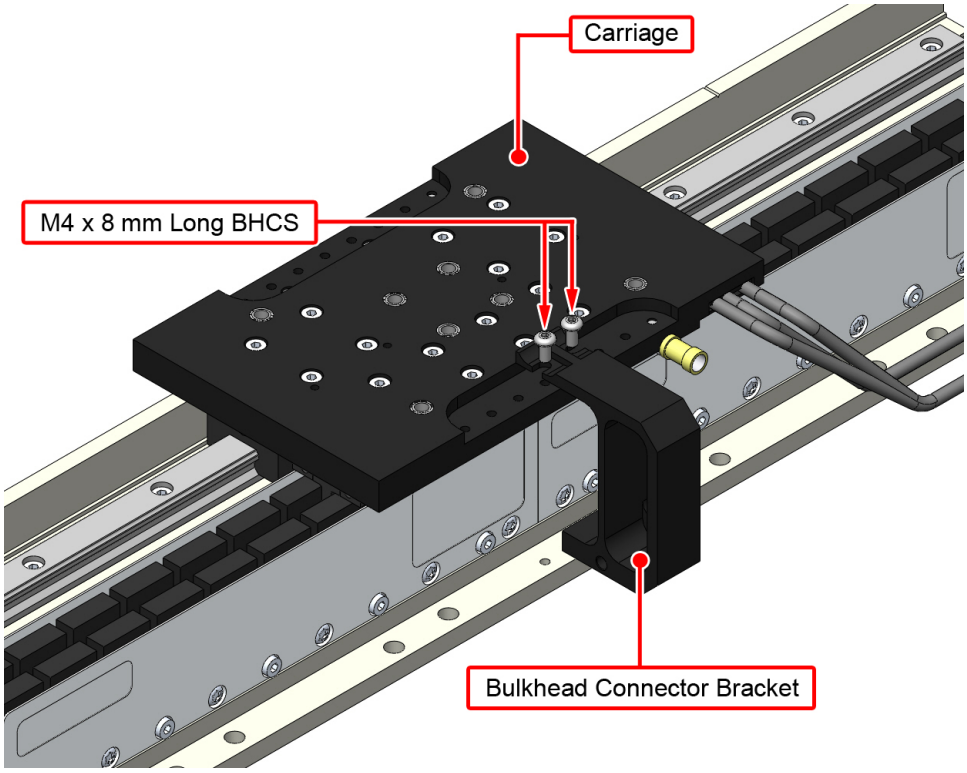


Figure 2-4: Bulkhead Bracket Installation — Attachment of Bracket to Carriage

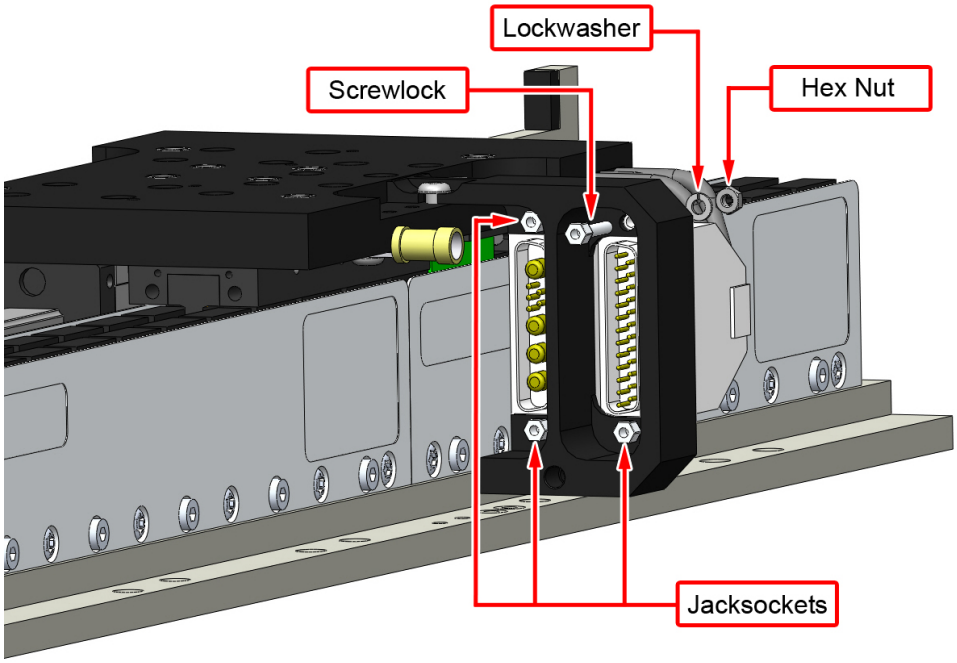


Figure 2-5: Bulkhead Bracket Installation — Connector Assembly

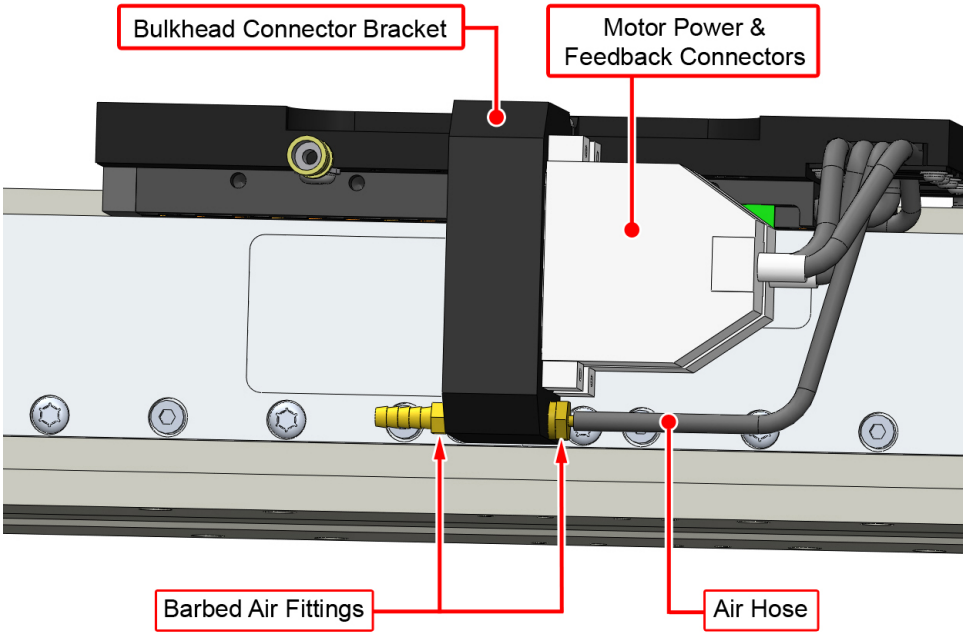


Figure 2-6: Bulkhead Bracket Installation — Air Fittings Assembly

2.6. Electrical Installation

Electrical installation requirements vary depending on linear motor actuator options. Installation instructions in this section are for linear motor actuators equipped with standard Aerotech linear motors intended for use with an Aerotech motion control system. Contact Aerotech for further information regarding linear motor actuators that are otherwise configured.

Aerotech motion control systems are adjusted at the factory for optimum performance. When the ACT series linear motor actuator is part of a complete Aerotech motion control system, setup involves connecting a linear motor actuator to the appropriate drive chassis with the cables provided. Labels on the system components indicate the appropriate connections. However, refer to your drive manuals and documentation for additional installation and operation information. In some cases, if the system is uniquely configured, a drawing showing system interconnects is supplied.

A linear motor and a linear encoder are standard for all ACT series actuators. The electrical wiring from the motor and encoder are integrated into two main connectors at the factory, as shown in Figure 2-7. Refer to Section 3.6. for standard wiring pinouts.

WARNING: Never connect or disconnect any electrical component or connecting cable while power is applied, or serious damage can result.

WARNING: The stage's protective ground is located on pin A4 of the motor connector. If you are using cables other than those provided by Aerotech, you must connect pin A4 to a ground connection.

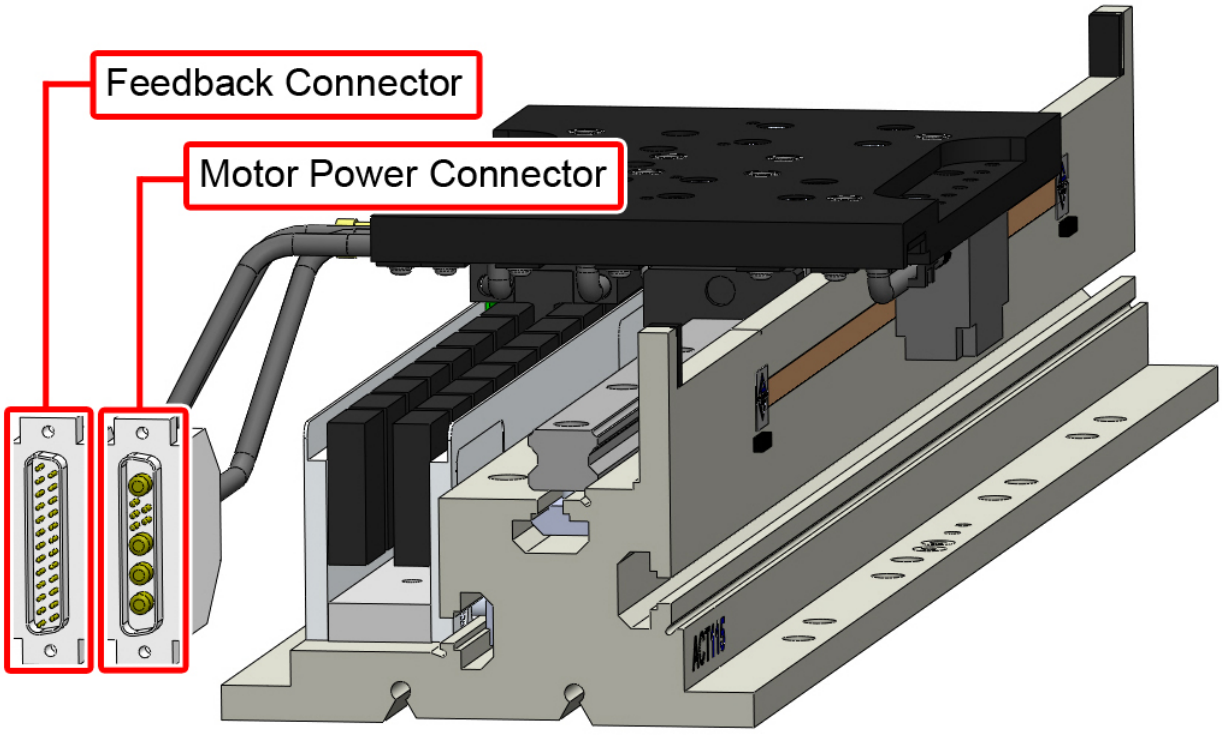


Figure 2-7: Motor and Feedback Connections

2.7. Electrical Cable Strain Relief

The user must provide an electrical cable strain relief for any ACT linear motor actuator that is constructed with either the -CONN-H or -CONN-NH cable management options (refer to Figure 2-8 for an example). Failure to implement a correct electrical cable strain relief can result in premature failure of the linear motor actuator and/or damage to the equipment. The -CMSXXXX-H option is recommended for applications requiring a complete cable management solution.

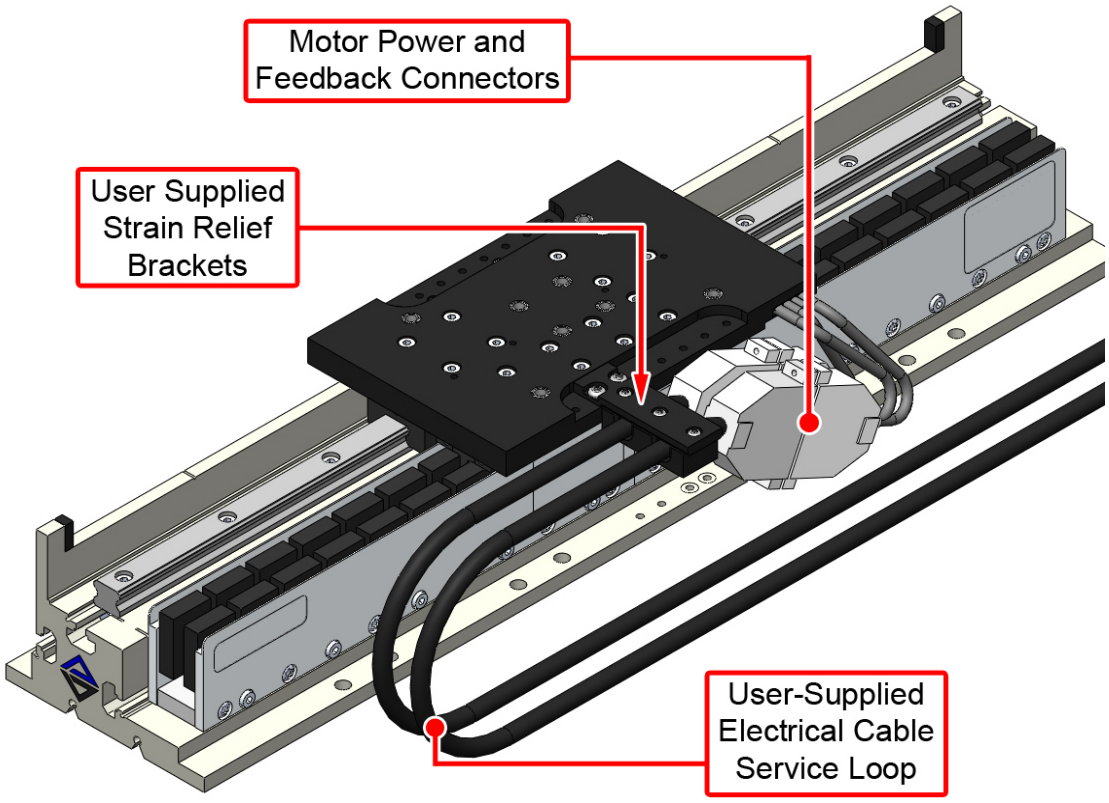

Motor Power and Feedback Connectors
User Supplied Strain Relief Brackets
User-Supplied Electrical Cable Service Loop

Figure 2-8: Example of an Electrical Cable Strain Relief

2.8. Air Requirements

An air supply is only needed for those ACT models that are equipped with the -FC linear motor forcer cooling option. Compressed air at a pressure of 138 kPa (20 psi) is required when using this feature. For the ACT 115DL and ACT 140DL linear motor actuators, it is recommended that air be supplied via a polyurethane air hose with an inner diameter of 2.5 mm (3/32”) or larger. For the ACT 165DL linear motor actuator, it is recommended that air be supplied via a polyurethane air hose with an inner diameter of 4 mm (5/32”) or larger. See Table 3-12, Table 3-13, and Table 3-14 for typical forcer cooling air flow rates.

Chapter 3: Operating Specifications

The surrounding environment and operating conditions can affect the performance and service life of the linear actuator. This chapter provides information on ideal environmental and operating conditions. Also included are instructions for estimating the load capability given various loadings.

3.1. Environmental Specifications

The environmental specifications for the ACT are listed in the following table.

Table 3-1: Environmental Specifications

Ambient Temperature	Operating: 10° to 35° C (50° to 95° F) The optimal operating temperature is 20° C ±2° C (68° F ±4° F). If at any time the operating temperature deviates from 20° C degradation in performance could occur. Contact Aerotech for information regarding your specific application and environment.
	Storage: 0° to 40° C (32° to 104° F) in original shipping packaging
Humidity	Operating: 40 percent to 60 percent RH The optimal operating humidity is 50 percent RH.
	Storage: 30 percent to 60 percent RH, non-condensing in original packaging
Altitude	Operating: 0 to 2,000 m (0 to 6,562 ft) above sea level Contact Aerotech if your specific application involves use above 2,000 m or below sea level.
Vibration	Use the system in a low vibration environment. Excessive floor or acoustical vibration can affect linear actuator and system performance. Contact Aerotech for information regarding your specific application.
Dust Exposure	The ACT linear motor actuators are not suited for dusty or wet environments. This equates to an ingress protection rating of IP00.
Use	Indoor use only

WARNING: Do not expose the ACT to environments or conditions outside the specified range of operating environments. Operation in conditions other than those specified can cause damage to the equipment.

3.2. Accuracy and Temperature Effects

When an ACT series linear motor actuator is ordered with the -PLOTS metrology option, the accuracy specification is measured at the center of the carriage, 25 mm above the carriage's mounting surface, with the linear motor actuator in a horizontal orientation. The linear motor actuator is assumed to be fully supported by a mounting surface that meets or exceeds the specification described in Section 2.2.

The accuracy specifications listed in Section 3.3. assume a 20º C operating environment. If the temperature of the linear motor actuator differs from 20º C, then the encoder scale mounted directly to the linear motor actuator's base will expand or contract at a rate of 23.6 ppm per °C.

3.3. Basic Specifications

Basic specifications provided in this section include: mechanical and electrical specifications, encoder resolution information, and BLMC-142, BLM-142, and BLMH-142 motor specifications.

For the most recent specifications, see www.aerotech.com.

Table 3-2: ACT115DL Series Mechanical Specifications (-0100 to -0500)

Mechanical Specifications		ACT115DL				
		-0100	-0200	-0300	-0400	-0500
Travel		100 mm	200 mm	300 mm	400 mm	500 mm
Accuracy(1)	Uncalibrated	±7 µm	±13 µm	±19 µm	±25 µm	±31 µm
	Calibrated(2)	±2 µm	±2 µm	±2 µm	±2 µm	±3 µm
Resolution		0.005 - 1 µm				
Repeatability (Bi-Directional)(1,3)		±1 µm				
Maximum Speed(4)		5 m/s				
Maximum Acceleration (Continuous)(4)		3 g				
Maximum Force (Continuous)	20 psi	120.3 N				
	No Air	77.7 N				
Load Capacity(5)	Horizontal	20 kg				
	Side	10 kg				
Moving Mass		1.4 kg				
Stage Mass		7.3 kg	9.1 kg	10.9 kg	12.7 kg	14.5 kg
Material		Aluminum (Clear Anodize Base/Black Anodize Tabletop)				
MTBF (Mean Time Between Failure)		20,000 Hours				
Drive System		Brushless Linear Servomotor (BLMC-142-A)				

1. Testing conducted only when "-PLOTS" metrology option is ordered.
2. Calibration available with HALAR option.
3. Bi-directional repeatability specification listed requires resolution of 0.1 µm or finer. Specification is ±2 µm with resolution of 0.5 µm. Coarser resolutions will result in reduced bi-directional repeatability performance.
4. Maximum velocity and acceleration specifications assume a small payload. As payload increases, the maximum attainable velocity and acceleration will decrease. Maximum application velocity may be limited by system data rate and resolution.
5. Axis orientation for on-axis loading is listed.
6. Specifications are for single-axis systems measured 25 mm above the tabletop. Consult factory for non-standard applications.

Table 3-3: ACT115DL Series Mechanical Specifications (-0600 to -1500)

Mechanical Specifications		ACT115DL				
		-0600	-0800	-1000	-1200	-1500
Travel		600 mm	800 mm	1000 mm	1200 mm	1500 mm
Accuracy(1)	Uncalibrated	±36 µm	±44 µm	±50 µm	±55 µm	±60 µm
	Calibrated(2)	±3 µm	±3 µm	±5 µm	±5 µm	±5 µm
Resolution		0.005 - 1 µm				
Repeatability (Bi-Directional)(1,3)		±1 µm				
Maximum Speed(4)		5 m/s				
Maximum Acceleration (Continuous)(4)		3 g				
Maximum Force (Continuous)	20 psi	120.3 N				
	No Air	77.7 N				
Load Capacity(5)	Horizontal	20 kg				
	Side	10 kg				
Moving Mass		1.4 kg				
Stage Mass		16.3 kg	20.0 kg	23.6 kg	27.2 kg	32.7 kg
Material		Aluminum (Clear Anodize Base/Black Anodize Tabletop)				
MTBF (Mean Time Between Failure)		20,000 Hours				
Drive System		Brushless Linear Servomotor (BLMC-142-A)				

1. Testing conducted only when "-PLOTS" metrology option is ordered.
2. Calibration available with HALAR option.
3. Bi-directional repeatability specification listed requires resolution of 0.1 µm or finer. Specification is ±2 µm with resolution of 0.5 µm. Coarser resolutions will result in reduced bi-directional repeatability performance.
4. Maximum velocity and acceleration specifications assume a small payload. As payload increases, the maximum attainable velocity and acceleration will decrease. Maximum application velocity may be limited by system data rate and resolution.
5. Axis orientation for on-axis loading is listed.
6. Specifications are for single-axis systems measured 25 mm above the tabletop. Consult factory for non-standard applications.

Table 3-4: ACT115DL Series Electrical Specifications

Electrical Specifications	ACT115DL
Feedback	Noncontact Linear Encoder
Maximum Bus Voltage	320 VDC
Limit Switches	5 V, Normally Closed
Home Switch	Near Center

Table 3-5: ACT140DL Series Mechanical Specifications (-0100 to -0500)

Mechanical Specifications		ACT140DL				
		-0100	-0200	-0300	-0400	-0500
Travel		100 mm	200 mm	300 mm	400 mm	500 mm
Accuracy(1)	Uncalibrated	±7 µm	±13 µm	±19 µm	±25 µm	±31 µm
	Calibrated(2)	±2 µm	±2 µm	±2 µm	±2 µm	±3 µm
Resolution		0.005 - 1 µm				
Repeatability (Bi-Directional)(1,3)		±1 µm				
Maximum Speed(4)		5 m/s				
Maximum Acceleration (Continuous)(4)		5 g				
Maximum Force (Continuous)	20 psi	173.2 N				
	No Air	110.5 N				
Load Capacity(5)	Horizontal	40 kg				
	Side	20 kg				
Moving Mass		2.5 kg				
Stage Mass		13.8 kg	17.0 kg	19.5 kg	22.7 kg	25.3 kg
Material		Aluminum (Clear Anodize Base/Black Anodize Tabletop)				
MTBF (Mean Time Between Failure)		20,000 Hours				
Drive System		Brushless Linear Servomotor (BLM-142-A)				

1. Testing conducted only when "-PLOTS" metrology option is ordered.
2. Calibration available with HALAR option.
3. Bi-directional repeatability specification listed requires resolution of 0.1 µm or finer. Specification is ±2 µm with resolution of 0.5 µm. Coarser resolutions will result in reduced bi-directional repeatability performance.
4. Maximum velocity and acceleration specifications assume a small payload. As payload increases, the maximum attainable velocity and acceleration will decrease. Maximum application velocity may be limited by system data rate and resolution.
5. Axis orientation for on-axis loading is listed.
6. Specifications are for single-axis systems measured 25 mm above the tabletop. Consult factory for non-standard applications.

Table 3-6: ACT140DL Series Mechanical Specifications (-0600 to -1500)

Mechanical Specifications		ACT140DL				
		-0600	-0800	-1000	-1200	-1500
Travel		600 mm	800 mm	1000 mm	1200 mm	1500 mm
Accuracy(1)	Uncalibrated	±36 µm	±44 µm	±50 µm	±55 µm	±60 µm
	Calibrated(2)	±3 µm	±3 µm	±5 µm	±5 µm	±5 µm
Resolution		0.005 - 1 µm				
Repeatability (Bi-Directional)(1,3)		±1 µm				
Maximum Speed(4)		5 m/s				
Maximum Acceleration (Continuous)(4)		5 g				
Maximum Force (Continuous)	20 psi	173.2 N				
	No Air	110.5 N				
Load Capacity(5)	Horizontal	40 kg				
	Side	20 kg				
Moving Mass		2.5 kg				
Stage Mass		28.5 kg	34.3 kg	40.7 kg	46.4 kg	55.4 kg
Material		Aluminum (Clear Anodize Base/Black Anodize Tabletop)				
MTBF (Mean Time Between Failure)		20,000 Hours				
Drive System		Brushless Linear Servomotor (BLM-142-A)				

1. Testing conducted only when "-PLOTS" metrology option is ordered.
2. Calibration available with HALAR option.
3. Bi-directional repeatability specification listed requires resolution of 0.1 µm or finer. Specification is ±2 µm with resolution of 0.5 µm. Coarser resolutions will result in reduced bi-directional repeatability performance.
4. Maximum velocity and acceleration specifications assume a small payload. As payload increases, the maximum attainable velocity and acceleration will decrease. Maximum application velocity may be limited by system data rate and resolution.
5. Axis orientation for on-axis loading is listed.
6. Specifications are for single-axis systems measured 25 mm above the tabletop. Consult factory for non-standard applications.

Table 3-7: ACT140DL Series Electrical Specifications

Electrical Specifications	ACT140DL
Feedback	Noncontact Linear Encoder
Maximum Bus Voltage	320 VDC
Limit Switches	5 V, Normally Closed
Home Switch	Near Center

Table 3-8: ACT165DL Series Mechanical Specifications (-0100 to -0500)

Mechanical Specifications		ACT165DL				
		-0100	-0200	-0300	-0400	-0500
Travel		100 mm	200 mm	300 mm	400 mm	500 mm
Accuracy(1)	Uncalibrated	±7 µm	±13 µm	±19 µm	±25 µm	±31 µm
	Calibrated(2)	±2 µm	±2 µm	±2 µm	±2 µm	±3 µm
Resolution		0.005 - 1 µm				
Repeatability (Bi-Directional)(1,3)		±1 µm				
Maximum Speed(4)		5 m/s				
Maximum Acceleration (Continuous)(4)		5 g				
Maximum Force (Continuous)	20 psi	270.7 N				
	No Air	150.0 N				
Load Capacity(5)	Horizontal	60 kg				
	Side	30 kg				
Moving Mass		3.0 kg				
Stage Mass		23.4 kg	29.1 kg	33.4 kg	39.0 kg	44.7 kg
Material		Aluminum (Clear Anodize Base/Black Anodize Tabletop)				
MTBF (Mean Time Between Failure)		20,000 Hours				
Drive System		Brushless Linear Servomotor (BLMH-142-A)				

1. Testing conducted only when "-PLOTS" metrology option is ordered.
2. Calibration available with HALAR option.
3. Bi-directional repeatability specification listed requires resolution of 0.1 µm or finer. Specification is ±2 µm with resolution of 0.5 µm. Coarser resolutions will result in reduced bi-directional repeatability performance.
4. Maximum velocity and acceleration specifications assume a small payload. As payload increases, the maximum attainable velocity and acceleration will decrease. Maximum application velocity may be limited by system data rate and resolution.
5. Axis orientation for on-axis loading is listed.
6. Specifications are for single-axis systems measured 25 mm above the tabletop. Consult factory for non-standard applications.

Table 3-9: ACT165DL Series Mechanical Specifications (-0600 to -1500)

Mechanical Specifications		ACT165DL				
		-0600	-0800	-1000	-1200	-1500
Travel		600 mm	800 mm	1000 mm	1200 mm	1500 mm
Accuracy(1)	Uncalibrated	±36 µm	±44 µm	±50 µm	±55 µm	±60 µm
	Calibrated(2)	±3 µm	±3 µm	±5 µm	±5 µm	±5 µm
Resolution		0.005 - 1 µm				
Repeatability (Bi-Directional)(1,3)		±1 µm				
Maximum Speed(4)		5 m/s				
Maximum Acceleration (Continuous)(4)		5 g				
Maximum Force (Continuous)	20 psi	270.7 N				
	No Air	150.0 N				
Load Capacity(5)	Horizontal	60 kg				
	Side	30 kg				
Moving Mass		3.0 kg				
Stage Mass		48.9 kg	60.3 kg	70.2 kg	80.1 kg	95.7 kg
Material		Aluminum (Clear Anodize Base/Black Anodize Tabletop)				
MTBF (Mean Time Between Failure)		20,000 Hours				
Drive System		Brushless Linear Servomotor (BLMH-142-A)				

1. Testing conducted only when "-PLOTS" metrology option is ordered.
2. Calibration available with HALAR option.
3. Bi-directional repeatability specification listed requires resolution of 0.1 µm or finer. Specification is ±2 µm with resolution of 0.5 µm. Coarser resolutions will result in reduced bi-directional repeatability performance.
4. Maximum velocity and acceleration specifications assume a small payload. As payload increases, the maximum attainable velocity and acceleration will decrease. Maximum application velocity may be limited by system data rate and resolution.
5. Axis orientation for on-axis loading is listed.
6. Specifications are for single-axis systems measured 25 mm above the tabletop. Consult factory for non-standard applications.

Table 3-10: ACT165DL Series Electrical Specifications

Electrical Specifications	ACT165DL
Feedback	Noncontact Linear Encoder
Maximum Bus Voltage	320 VDC
Limit Switches	5 V, Normally Closed
Home Switch	Near Center

Table 3-11: ACT Series Resolution Information

Code	Signal Period	Travel/Step	Multiplier
-AS	20 µm	0.005 µm - 1.0 µm	Requires External
-0.1	20 µm	0.1 µm	Integral x50
-0.5	20 µm	0.5 µm	Integral x10

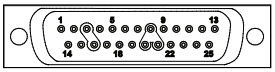
Code	Maximum Speed	Signal Type	Encoder Connector
-AS	System Data Rate (up to 5.0 m/s)		
-0.1	1.3 m/s max (1)		
-0.5	3.0 m/s max (1)		
1. Requires system data rate of at least 24 MHz			

Table 3-12: BLMC-142-A Motor Specifications

	Specifications
Performance Specifications (1,5)	
Continuous Force, 20 psi, 1.4 bar (2)	120.3 N
	27.0 lb
Continuous Force, No Cooling, (2)	77.7 N
	17.5 lb
Peak Force (3)	481.2 N
	108.2 lb
Electrical Specifications (5)	
BEMF Constant (line to line, max)	21.28 V / m / sec
	0.54 V / in / sec
Continuous Current, 20 psi, 1.4 bar (2)	6.50 A, pk
	4.60 A, rms
Continuous Current, No Cooling (2)	4.20 A, pk
	2.97 A, rms
Peak Current, Stall (3)	26.00 A, pk
	18.38 A, rms
Force Constant, Sinusoidal Drive (4,8)	18.51 N / A, pk
	4.16 lb / A, pk
	26.17 N / A, rms
	5.88 lb / A, rms
Motor Constant (2,4)	8.24 N / $\sqrt{W}$
	1.85 lb / $\sqrt{W}$
Resistance, 25 °C (line to line)	4.8 Ohms
Inductance (line to line)	1.33 mH
Thermal Resistance, 20 psi, 1.4 bar	0.47 °C / W
Thermal Resistance, No Cooling	1.12 °C / W
Maximum Bus Voltage	340 VDC
Mechanical Specifications (5)	
Air Flow, 20 psi	$1.7x10^{-3}$ m^3/s
	3.6 SCFM
Magnetic Pole Pitch	25 mm
	0.98 in

1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature
2. Values shown @ 100 °C rise above a 25 °C ambient temperature, with motor mounted to the specified aluminum heat sink
3. Peak force assumes correct rms current, consult Aerotech
4. Force Constant and Motor Constant specified at stall
5. All performance and electrical specifications +/- 10%
6. Maximum winding temperature is 125 °C
7. Ambient operating temperature range: 0 °C - 25 °C, consult Aerotech for performance in elevated ambient temperatures
8. All Aerotech amplifiers are rated Apk; use torque constant in N-m / Apk when sizing

Table 3-13: BLM-142-A Motor Specifications

	Specifications
Performance Specifications (1,5)	
Continuous Force, 20 psi, 1.4 bar (2)	173.2 N
	38.9 lb
Continuous Force, No Cooling, (2)	110.5 N
	24.8 lb
Peak Force (3)	692.7 N
	155.7 lb
Electrical Specifications (5)	
BEMF Constant (line to line, max)	40.96 V / m / sec
	1.04 V / in / sec
Continuous Current, 20 psi, 1.4 bar (2)	4.86 A, pk
	3.44 A, rms
Continuous Current, No Cooling (2)	3.10 A, pk
	2.19 A, rms
Peak Current, Stall (3)	19.44 A, pk
	13.75 A, rms
Force Constant, Sinusoidal Drive (4,8)	35.63 N / A, pk
	8.01 lb / A, pk
	50.39 N / A, rms
	11.33 lb / A, rms
Motor Constant (2,4)	10.53 N / $\sqrt{W}$
	2.37 lb / $\sqrt{W}$
Resistance, 25 °C (line to line)	10.9 Ohms
Inductance (line to line)	8.70 mH
Thermal Resistance, 20 psi, 1.4 bar	0.37 °C / W
Thermal Resistance, No Cooling	0.91 °C / W
Maximum Bus Voltage	340 VDC
Mechanical Specifications (5)	
Air Flow, 20 psi	$1.7x10^{-3}$ m^3/s
	3.5 SCFM
Magnetic Pole Pitch	30.48 mm
	1.20 in

1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature
2. Values shown @ 100 °C rise above a 25 °C ambient temperature, with motor mounted to the specified aluminum heat sink
3. Peak force assumes correct rms current, consult Aerotech
4. Force Constant and Motor Constant specified at stall
5. All performance and electrical specifications +/- 10%
6. Maximum winding temperature is 125 °C
7. Ambient operating temperature range: 0 °C - 25 °C, consult Aerotech for performance in elevated ambient temperatures
8. All Aerotech amplifiers are rated Apk; use torque constant in N-m / Apk when sizing

Table 3-14: BLMH-142-A Motor Specifications

	Specifications
Performance Specifications (1,5)	
Continuous Force, 20 psi, 1.4 bar (2)	270.7 N
	60.9 lb
Continuous Force, No Cooling, (2)	150.0 N
	33.7 lb
Peak Force (3)	1082.7 N
	243.4 lb
Electrical Specifications (5)	
BEMF Constant (line to line, max)	32.11 V / m / sec
	0.82 V / in / sec
Continuous Current, 20 psi, 1.4 bar (2)	9.69 A, pk
	6.85 A, rms
Continuous Current, No Cooling (2)	5.37 A, pk
	3.80 A, rms
Peak Current, Stall (3)	38.76 A, pk
	27.41 A, rms
Force Constant, Sinusoidal Drive (4,8)	27.93 N / A, pk
	6.28 lb / A, pk
	39.50 N / A, rms
	8.88 lb / A, rms
Motor Constant (2,4)	14.17 N / $\sqrt{W}$
	3.19 lb / $\sqrt{W}$
Resistance, 25 °C (line to line)	3.7 Ohms
Inductance (line to line)	2.40 mH
Thermal Resistance, 20 psi, 1.4 bar	0.27 °C / W
Thermal Resistance, No Cooling	0.89 °C / W
Maximum Bus Voltage	340 VDC
Mechanical Specifications (5)	
Air Flow, 20 psi	$2.5x10^{-3}$ m^3/s
	5.3 SCFM
Magnetic Pole Pitch	30.00 mm
	1.18 in

1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature
2. Values shown @ 100 °C rise above a 25 °C ambient temperature, with motor mounted to the specified aluminum heat sink
3. Peak force assumes correct rms current, consult Aerotech
4. Force Constant and Motor Constant specified at stall
5. All performance and electrical specifications +/- 10%
6. Maximum winding temperature is 125 °C
7. Ambient operating temperature range: 0 °C - 25 °C, consult Aerotech for performance in elevated ambient temperatures
8. All Aerotech amplifiers are rated Apk; use torque constant in N-m / Apk when sizing

3.4. Load Capability

It is recommended that application loads be symmetrically distributed whenever possible (that is, the payload should be centered on the carriage and the entire linear motor actuator should be centered on the support structure). When the linear motor actuator is lying flat (horizontal) and the application load is vertically applied and symmetrically distributed, the maximum load carrying capacities of the ACT are as follows.

Table 3-15: Maximum Horizontal Load Capacity per ACT Model

ACT Model	Maximum Horizontal Load Capacity
115DL	20 kilograms
140DL	40 kilograms
165DL	60 kilograms

If a cantilevered load is applied, refer to Figure 3-1, Figure 3-2, Figure 3-3, and Figure 3-4 to find the maximum allowable load.

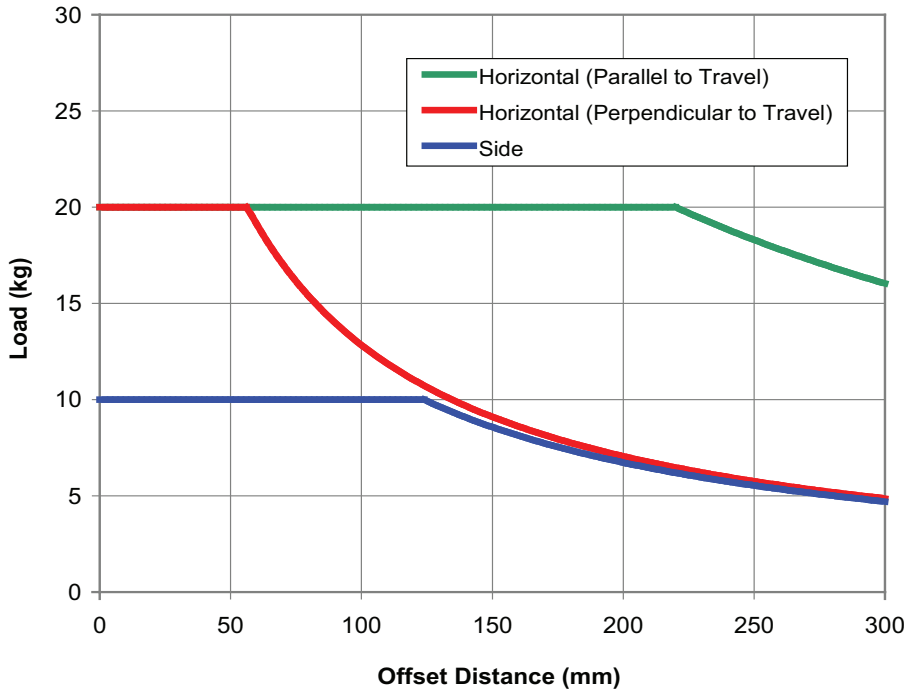


Figure 3-1: ACT115DL Cantilevered Load Capability

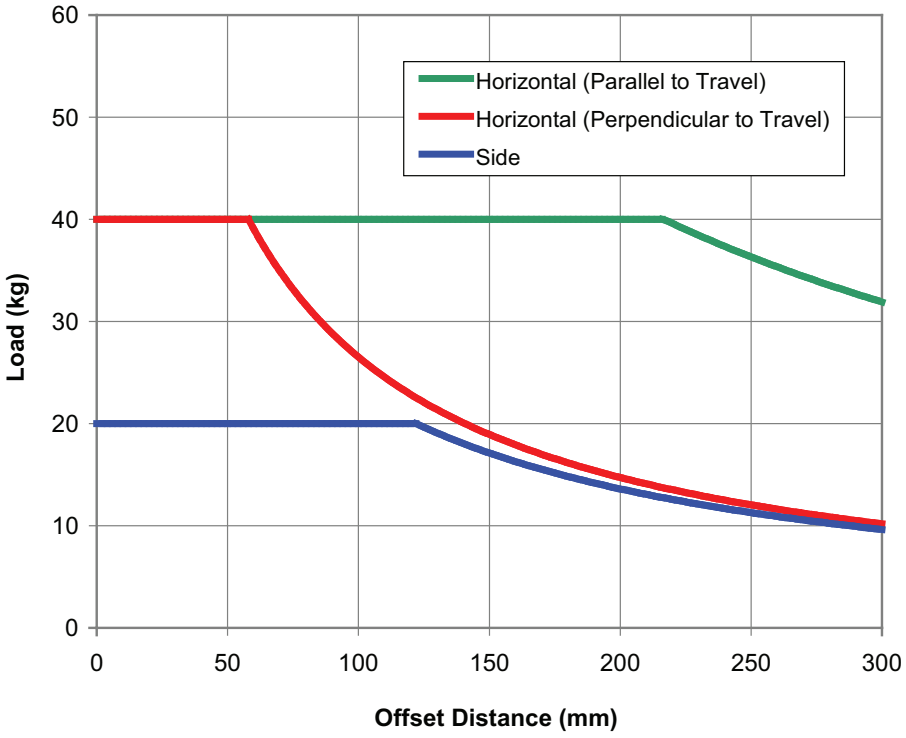


Figure 3-2: ACT140DL Cantilevered Load Capability

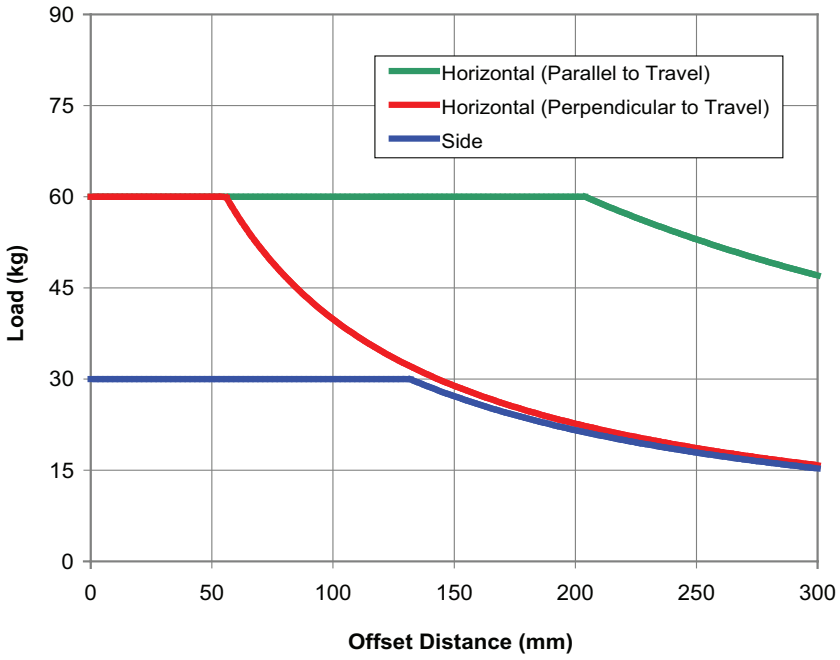


Figure 3-3: ACT165DL Cantilevered Load Capability

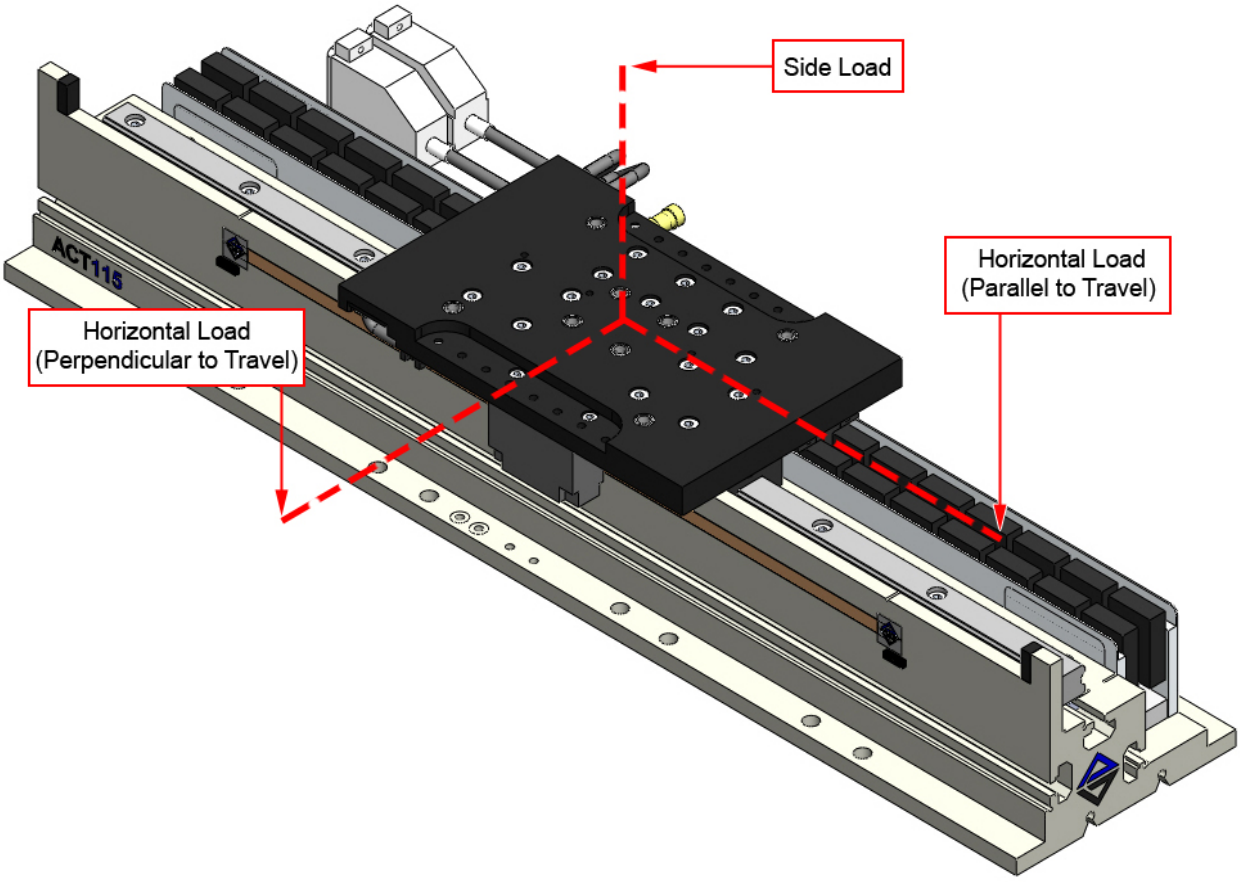


Figure 3-4: Cantilevered Load Diagram

Figure 3-5, Figure 3-6, and Figure 3-7 show the relationships between the mass carried by the linear motor actuator and the maximum acceleration capabilities. Both peak and continuous acceleration capabilities are presented. The maximum acceleration possible for the ACT115DL series is 3 g, and the maximum acceleration possible for both the ACT140DL and ACT165DL series is 5 g.

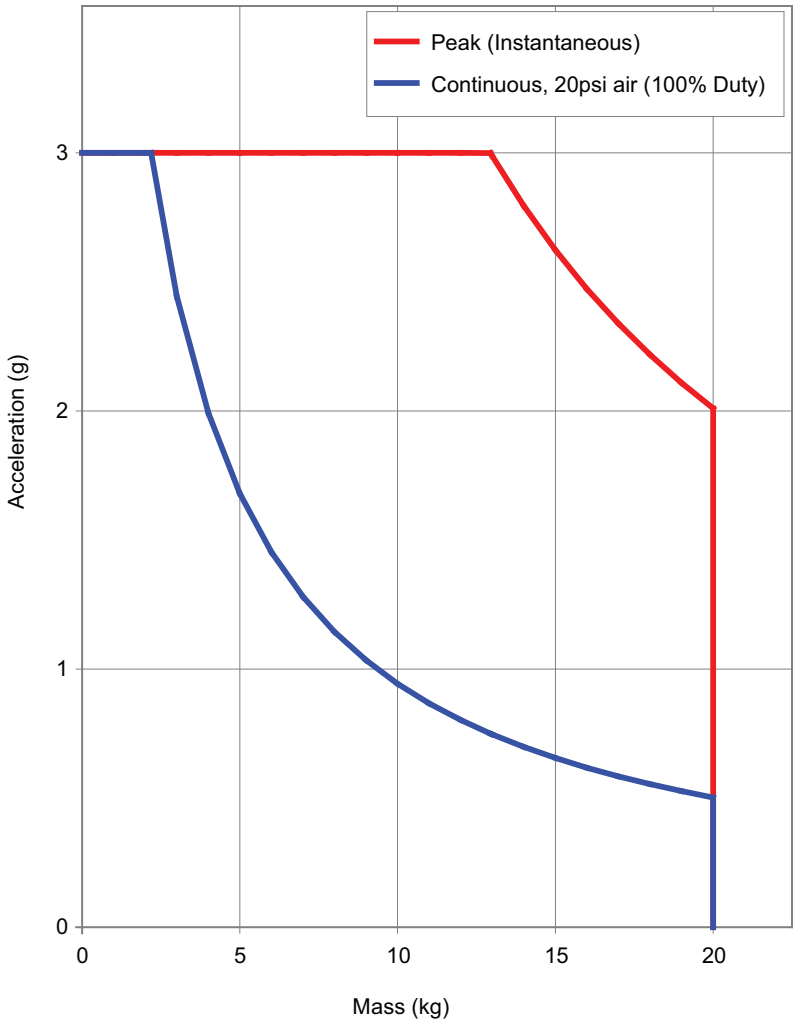


Figure 3-5: ACT115DL Acceleration vs. Mass

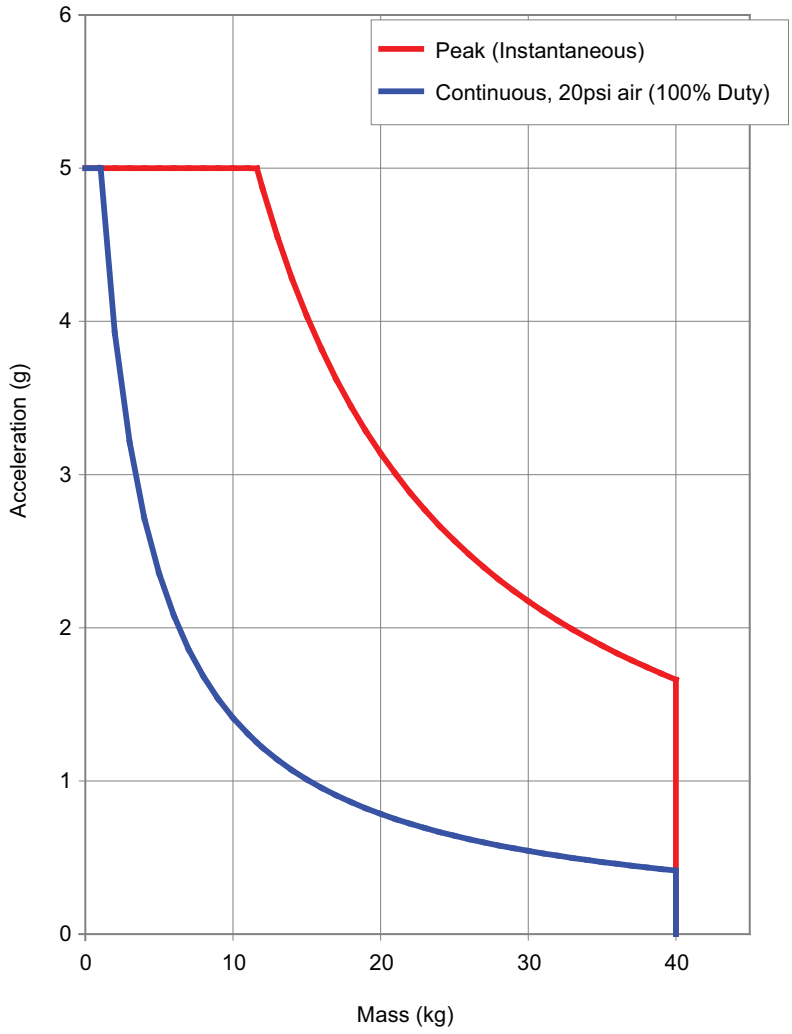


Figure 3-6: ACT140DL Acceleration vs. Mass

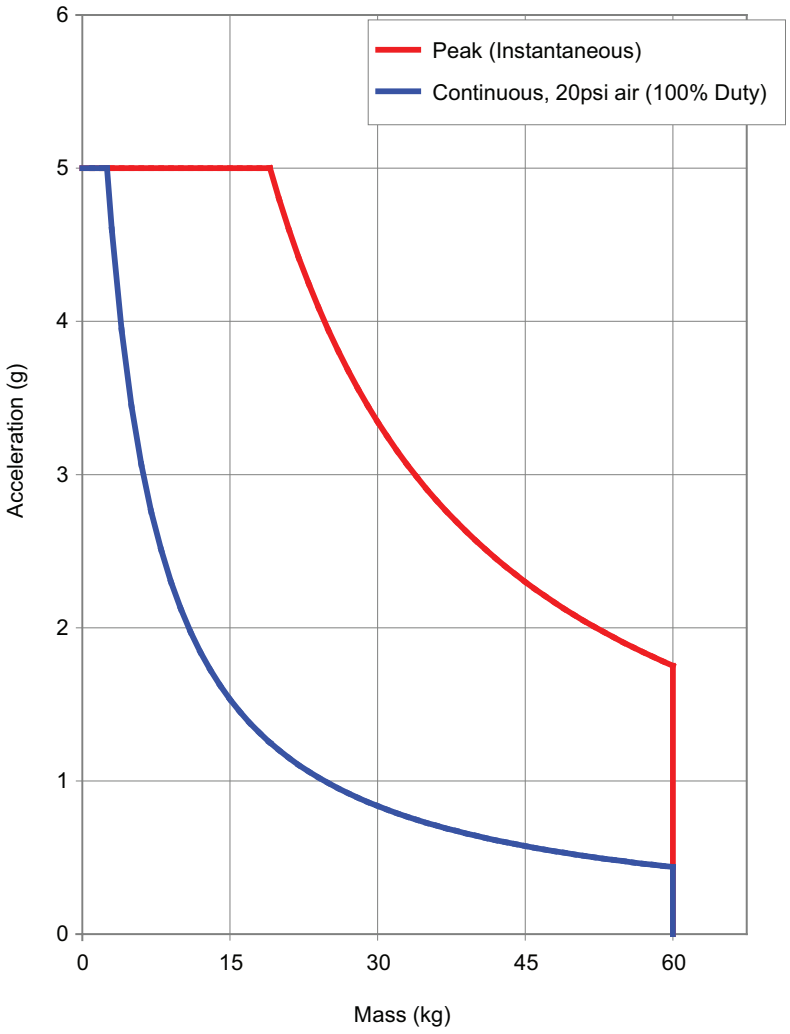


Figure 3-7: ACT165DL Acceleration vs. Mass

3.5. End of Travel Limits

ACT series linear motor actuators are provided with EOT (End of Travel) limits. These limits indicate to the motion controller when the linear motor actuator has reached its maximum useable travel in each direction.

3.5.1. Limit Operation

The EOT limits are integral to the encoder feedback read head and integrated into the feedback connector. These outputs change state when the linear motor actuator approaches its maximum travel distance and signals the motion controller. The ACT linear motor actuator limits operate as normally-closed (N.C.) current sinking outputs.

WARNING: If the linear motor actuator is driven approximately 5 mm beyond the electrical limit, it will encounter a mechanical stop. Although the operating speed of the linear motor actuator may be relatively slow, damage to the linear motor actuator could result.

3.5.2. Limit Switch Wiring

The ACT linear motor actuator has open-collector EOT limit outputs. Because they are open-collector devices, they can be interfaced to 5-24 Volt logic inputs.

The limit input to the controller is a logic 0 (typical 0.4 Volts @ 12.8 mA) when no EOT limit is present. When the EOT limit is activated, the switch (transistor) shuts off and the signal changes state to logic 1 (typically 4.8-5 Volts), because of the external user-supplied pull-up resistor. See Figure 3-8 for a diagram of limit switch wiring.

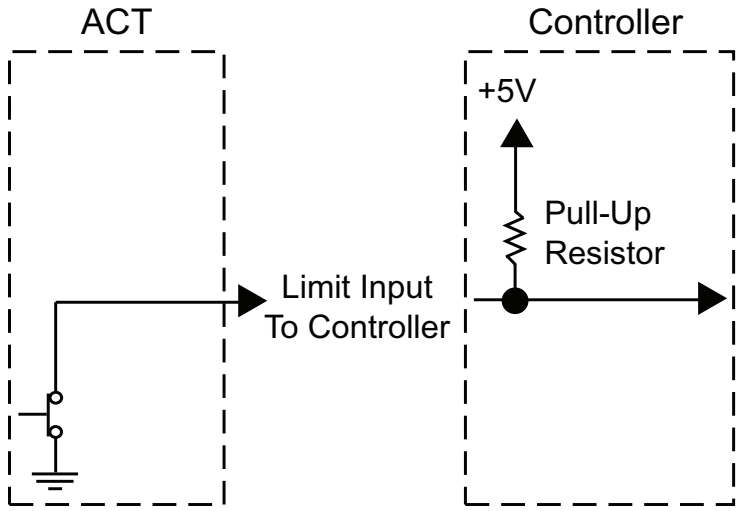


Figure 3-8: Limit Switch Wiring

3.5.3. Adjustable Limits

For applications that require easy adjustment of useable travel, the ACT series linear motor actuators can be equipped with optional moveable limits. The -NCA-5V option allows the user to move the EOT limits, within certain boundaries, to the locations necessary for their particular application.

The procedure for adjusting the moveable limits is as follows (see Figure 3-9).

1. Loosen the two M4 x 12 mm long button head socket cap screws (BHCS) that attach the adjustable limit plate to the base by about 1 turn. It is not necessary to completely disassemble the BHCS from the adjustable limit plate.
2. Slide the adjustable limit plate to the desired location.
3. Making sure that the bottom of the adjustable limit plate is seated against the reference ledge of the base, tighten the two BHCS that attach the adjustable limit plate to the base.

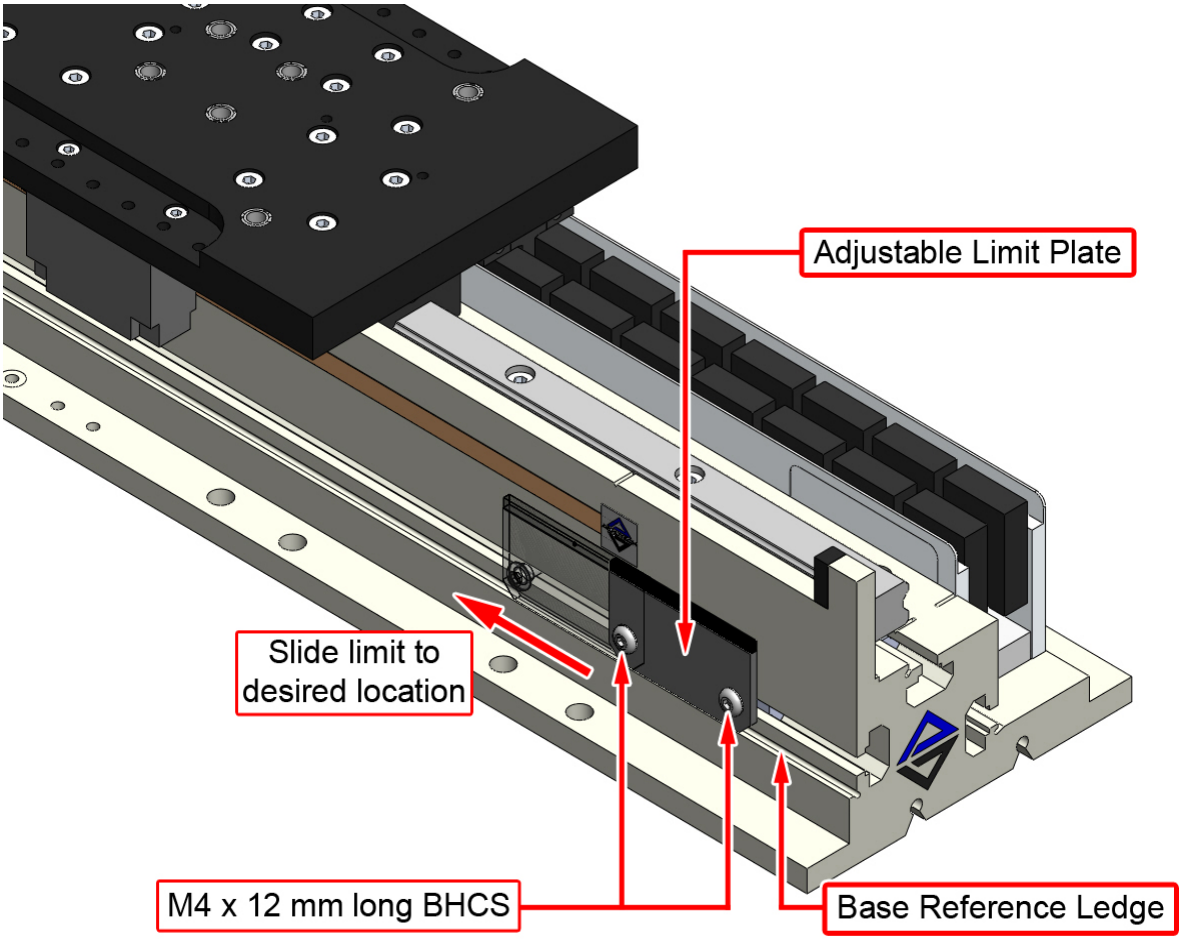
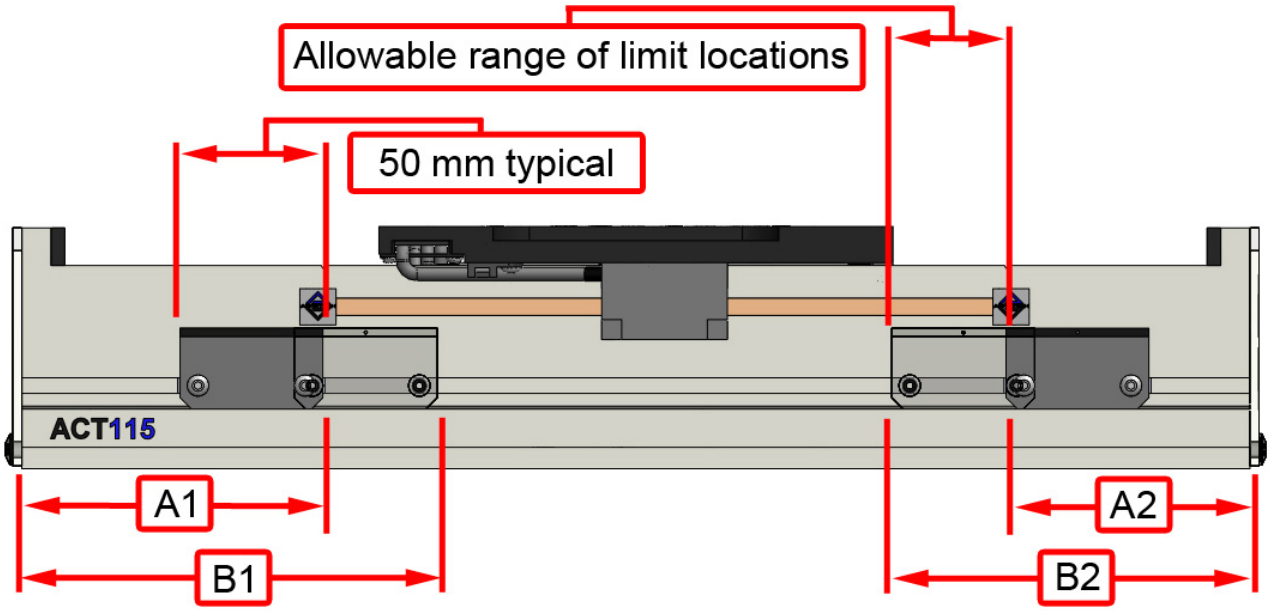


Figure 3-9: Adjustment of Moveable Limits

When you adjust the moveable limits, you must adhere to the following criteria.

1. Do not overextend the length of useable travel. This can result in a situation where the linear motor actuator does not have sufficient distance to decelerate after encountering the electrical limit and before contacting the mechanical stop. Even worse, the linear actuator could possibly impact the mechanical stop prior to reaching the electrical limit. Both of these scenarios can result in damage to the linear motor actuator.
2. Do not decrease the length of travel to the point where the linear motor actuator's EOT limit deactivates before reaching the mechanical stop. This can create a circumstance where the linear actuator becomes "trapped" between the electrical limit and the mechanical stop.

Figure 3-10 provides detailed information regarding the acceptable bounds of EOT limit adjustment.



	For Maximum Travel		For Minimum Travel	
ACT Model	**A1**	**A2**	**B1**	**B2**
ACT115DL	105.4 mm	85.4 mm	145.4 mm	124.4 mm
ACT140DL	127.9 mm	127.9 mm	167.9 mm	167.9 mm
ACT165DL	130.4 mm	130.4 mm	170.4 mm	170.4 mm

Figure 3-10: Acceptable Locations for Moveable Limits

In certain circumstances it might be necessary to reduce the travel length of the linear motor actuator beyond the boundaries specified in Figure 3-10. It is possible to accomplish this by stacking together two or more adjustable limit plates as shown in Figure 3-11. Contact the factory to obtain additional adjustable limit plates and for application assistance in implementing this solution.

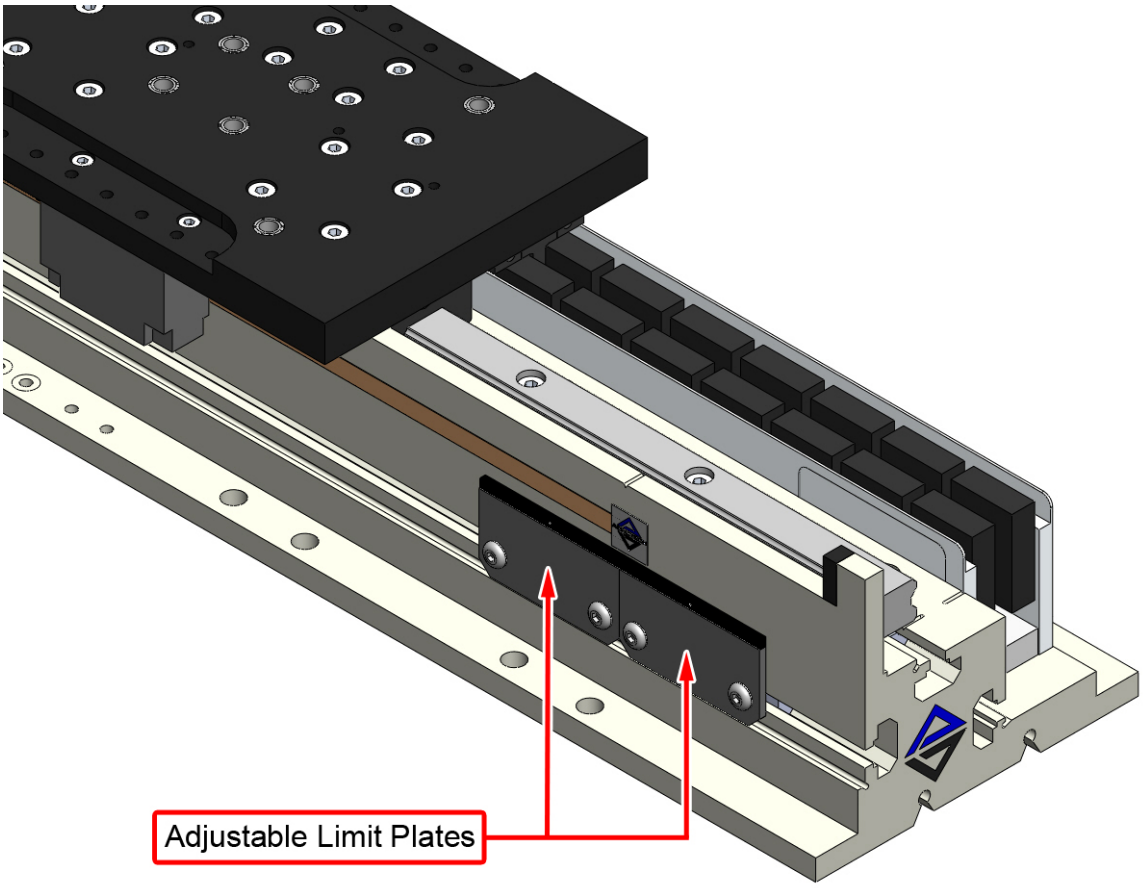


Figure 3-11: Stacked Moveable Limits

3.6. Standard Motor Wiring

ACT linear motor actuators fitted with standard motors and encoders come from the factory completely wired and assembled. For reference, connector pin outputs are given in Table 3-16 and Table 3-17.

Table 3-16: Motor Connector Pin Assignments

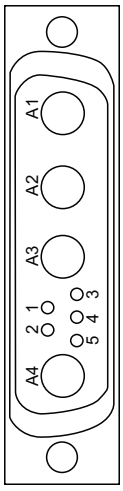
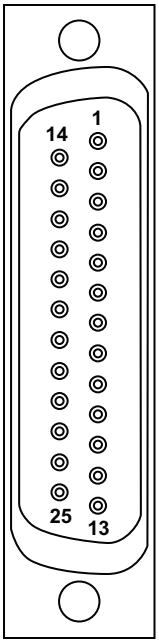
Pin	Description	Connector
A1	MTR ØA (Motor Phase A)	
A2	MTR ØB (Motor Phase B)	
A3	MTR ØC (Motor Phase C)	
1	MTR SHLD	
2	RESERVED: Not Used	
3	RESERVED: Not Used	
4	RESERVED: Not Used	
5	RESERVED: Not Used	
A4	From Ground	

Table 3-17: Feedback Connector Pin Assignments

Pin	Label	Description	Connector
1	SIG SHLD	Signal shield connection	
2	Thermistor	Positive lead for motor thermistor (to motion controller).	
3	Encoder +5V	+5 V supply input for optical encoders. Usual requirement is 250 mA.	
4	Reserved	Not Used	
5	HB	Hall Effect B. Brushless motor commutation track output. TTL line driven signal with rotary motor.	
6	MKR-N	Incremental encoder output; either the compliment of Marker with a line driven, TTL type encoder or 2.5 V DC bias level with amplified sine wave type encoder.	
7	MKR	Marker. Incremental encoder output pulse given once per revolution. Usually used for home reference cycle.	
8	Reserved	Not Used	
9	Reserved	Not Used	
10	HA	Hall Effect A. Brushless motor commutation track output. TTL line driven signal with rotary motor.	
11	HC	Hall Effect C. Brushless motor commutation track output. TTL line driven signal with rotary motor.	
12	+Limit / CW	Active high signal indicating maximum travel produced by positive stage direction.	
13	Reserved	Not Used	
14	COS	Cosine. Incremental encoder output; either TTL line driven or amplified sine wave type signal.	
15	COS-N	Incremental encoder output. Compliment of COS	
16	Limit +5V	+5V supply input for optical limit switch boards. Usual requirement is 50 mA.	
17	SIN	Sine. Incremental encoder output; either TTL line driven or amplified sign wave type signal. Sine. Incremental encoder output; either TTL line driven or amplified sign wave type signal.	
18	SIN-N	Incremental encoder output. Compliment of SIN.	
19	Reserved	Not Used	
20	Limit Common	Common ground to limit switch. Common ground to limit switch.	
21	Encoder Common	Common ground to encoder power. Common ground to encoder power.	
22	Reserved	Not Used	
23	Reserved	Not Used	
24	-Limit / CCW	Active high signal indicating maximum travel produced by positive stage direction.	
25	Reserved	Not Used	

3.7. Vacuum Operation

Contact Aerotech for information regarding operation in a vacuum environment.

Chapter 4: Maintenance

This chapter provides information about intervals between lubrications, details of the lubrication and inspection process, and recommendations of lubricants for use.

NOTE: The bearing area must be kept free of foreign matter and moisture; otherwise, the performance and life expectancy of the stage will be reduced. Refer to Section 2.8. for air requirements.

DANGER: To minimize the possibility of bodily injury or death, disconnect all electrical power prior to making any mechanical adjustments.

4.1. Service and Inspection Schedule

Lubricant inspection and replenishment in ACT series linear motor actuators depends on conditions such as duty cycle, speed and the environment. An inspection interval of once per month is recommended until a trend develops for the specific application and environment. Longer or shorter intervals might be required to maintain the film of lubricant on the bearing surfaces. In general, Aerotech recommends that linear motor actuators operating in a clean environment be lubricated annually, or every 500 km, whichever comes first. For linear motor actuators operating under conditions involving excessive debris, lubrication every six months is recommended.

4.2. Cleaning and Lubrication

4.2.1. Recommended Cleaning Solvents and Lubricants

If a solvent is necessary for cleaning the linear motor actuator, then it is recommended that isopropyl alcohol be used. Harsher solvents, such as acetone, can damage the plastic and rubber seals on the LMG trucks. Acetone should never be used on the encoder surfaces and magnet tracks because it could dissolve the epoxy that holds the magnets in place.

For standard LMG bearing rails, Shell Alvania EP2 grease is recommended. Comparable lithium-based No. 2 greases can also be used.

4.2.2. Important Notes on Cleaning and Lubrication

When cleaning or lubricating components of the ACT series linear motor actuators:

1. Use a clean, dry, soft, lint-free cloth for cleaning.
2. Take the opportunity during the lubrication procedure to inspect the linear motion guides for any damage or signs of wear.
3. In applications that have multiple linear motor actuators and stages bolted together to form multi-axis systems, precision alignments may be lost if components are loosened or disassembled.
4. Further disassembly of the linear motor actuator is not recommended because proper assembly and calibration can only be done at the factory. In addition, a laser interferometer may be needed for post-assembly verification in order to maintain warranties.

4.2.3. Cleaning and Lubrication Process

The cleaning process is outlined in the steps that follow. Before beginning lubrication, see Section 4.2.1. for recommended lubricants.

DANGER: Strong rare-earth magnets are present in the linear motor magnet track. Loose metal objects (tools, watches, keys, etc.) may cause personal injury and/or damage to the equipment.

DANGER: To minimize the possibility of bodily injury or death, disconnect all electrical power prior to making any mechanical adjustments.

1. Remove power to the linear motor actuator.
2. Remove any accumulated dust or debris from the linear motor actuator.
3. Remove any dirty or dried lubricant from the LMG bearing rails. Use a clean, lint-free cloth with a side-to-side motion. A swab soaked in isopropyl alcohol can be used to remove stubborn debris.
4. Clean the LMG bearing rails with a clean, lint-free cloth or swab.
5. Apply a thin, continuous film of lubricant to the LMG bearing rails. A good quality, natural bristle artist's brush makes an excellent applicator.
6. Manually move the linear motor actuator's carriage to the opposite end of travel. This will work the grease into the LMG trucks.
7. Repeat steps 2 through 5 for any areas that were inaccessible due to the carriage's original position.
8. Restore power to the linear motor actuator. Drive the carriage back to its original position in order to redistribute the lubricant.

Appendix A: Warranty and Field Service

Aerotech, Inc. warrants its products to be free from defects caused by faulty materials or poor workmanship for a minimum period of one year from date of shipment from Aerotech. Aerotech's liability is limited to replacing, repairing or issuing credit, at its option, for any products that are returned by the original purchaser during the warranty period. Aerotech makes no warranty that its products are fit for the use or purpose to which they may be put by the buyer, where or not such use or purpose has been disclosed to Aerotech in specifications or drawings previously or subsequently provided, or whether or not Aerotech's products are specifically designed and/or manufactured for buyer's use or purpose. Aerotech's liability or any claim for loss or damage arising out of the sale, resale or use of any of its products shall in no event exceed the selling price of the unit.

Laser Products

Aerotech, Inc. warrants its laser products to the original purchaser for a minimum period of one year from date of shipment. This warranty covers defects in workmanship and material and is voided for all laser power supplies, plasma tubes and laser systems subject to electrical or physical abuse, tampering (such as opening the housing or removal of the serial tag) or improper operation as determined by Aerotech. This warranty is also voided for failure to comply with Aerotech's return procedures.

Return Procedure

Claims for shipment damage (evident or concealed) must be filed with the carrier by the buyer. Aerotech must be notified within (30) days of shipment of incorrect materials. No product may be returned, whether in warranty or out of warranty, without first obtaining approval from Aerotech. No credit will be given nor repairs made for products returned without such approval. Any returned product(s) must be accompanied by a return authorization number. The return authorization number may be obtained by calling an Aerotech service center. Products must be returned, prepaid, to an Aerotech service center (no C.O.D. or Collect Freight accepted). The status of any product returned later than (30) days after the issuance of a return authorization number will be subject to review.

Returned Product Warranty Determination

After Aerotech's examination, warranty or out-of-warranty status will be determined. If upon Aerotech's examination a warranted defect exists, then the product(s) will be repaired at no charge and shipped, prepaid, back to the buyer. If the buyer desires an airfreight return, the product(s) will be shipped collect. Warranty repairs do not extend the original warranty period.

Returned Product Non-warranty Determination

After Aerotech's examination, the buyer shall be notified of the repair cost. At such time, the buyer must issue a valid purchase order to cover the cost of the repair and freight, or authorize the product(s) to be shipped back as is, at the buyer's expense. Failure to obtain a purchase order number or approval within (30) days of notification will result in the product(s) being returned as is, at the buyer's expense. Repair work is warranted for (90) days from date of shipment. Replacement components are warranted for one year from date of shipment.

Rush Service

At times, the buyer may desire to expedite a repair. Regardless of warranty or out-of-warranty status, the buyer must issue a valid purchase order to cover the added rush service cost. Rush service is subject to Aerotech's approval.

On-site Warranty Repair

If an Aerotech product cannot be made functional by telephone assistance or by sending and having the customer install replacement parts, and cannot be returned to the Aerotech service center for repair, and if Aerotech determines the problem could be warranty-related, then the following policy applies:

Aerotech will provide an on-site field service representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs. For warranty field repairs, the customer will not be charged for the cost of labor and material.

If service is rendered at times other than normal work periods, then special service rates apply. If during the on-site repair it is determined the problem is not warranty related, then the terms and conditions stated in the following "On-Site Non-Warranty Repair" section apply.

On-site Non-warranty Repair

If any Aerotech product cannot be made functional by telephone assistance or purchased replacement parts, and cannot be returned to the Aerotech service center for repair, then the following field service policy applies:

Aerotech will provide an on-site field service representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs and the prevailing labor cost, including travel time, necessary to complete the repair.

Company Address

Aerotech, Inc.
101 Zeta Drive
Pittsburgh, PA 15238
USA

Phone: 412-963-7470
Fax: 412-963-7459

Appendix B: Technical Changes

Table B-1: Current Changes (1.01.00)

Section(s) Affected	General Information
Section 1.1.2. , Section 3.2. , Section 3.3.	Metrology option name change (from -STANDARD to -NO PLOTS and -CERTIFIED to -PLOTS)

Table B-2: Archived Changes

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Reader's Comments

ACT Series Manual
P/N: EDS171, December 30, 2011
Revision 1.01.00

Is this manual

	YES	NO
Adequate to the subject		
Well organized		
Clearly presented		
Well illustrated		

How do you use this document in your job? Does it meet your needs? What improvements, if any, would you like to see? Please be specific or cite examples.

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Model #			Title	
Serial #			Company Name	
Date Shipped			Address	
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	Email:
	service@aerotech.com